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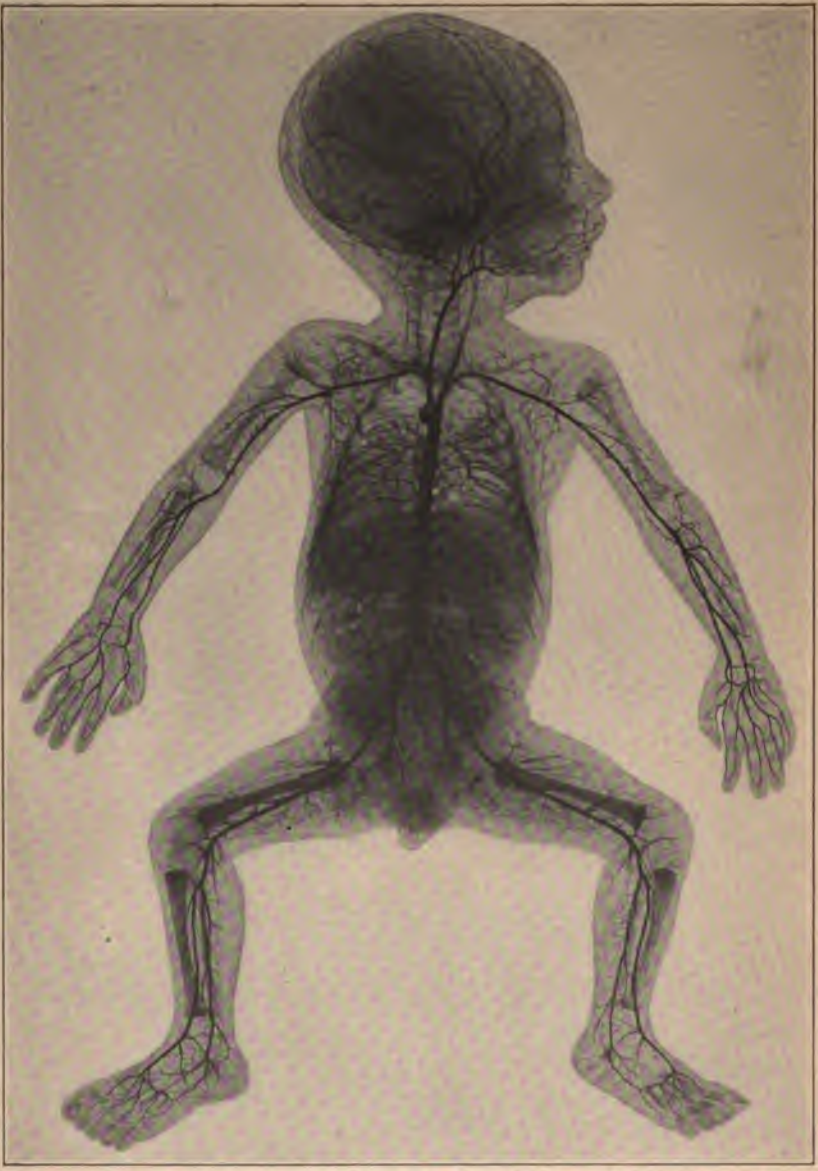
OBSTETRICS
FOR NURSES



X-ray of eight-months fetus—arteries injected with bismuth. (Photograph and print by Dr. Eben C. Hill; retouched by Max Brödel.)

OBSTETRICS
FOR NURSES

BY

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AFFECTIONATELY DEDICATED
TO MY WIFE,
AN AMERICAN NURSE AND MOTHER

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PREFACE

While actively engaged in instructing nurses in the classroom and in the wards, it became apparent that the existing textbooks on obstetrics were quite unsatisfactory adjuncts to such efforts, the standard medical works being too complicated and technical, while the special nurses' books go into so much detail that the fundamental facts are apt to be overlooked. Moreover, in the latter neither the subject matter nor the illustrative material compares favorably with that offered our medical students. Consequently, many nurses use no textbook but rely upon their lecture notes and ward instruction, while an ambitious few always seek out the larger books and have difficulty in culling the information they especially desire.

These observations engendered the idea of writing a condensed textbook, which should incorporate the essence of the knowledge of obstetrics into as simple language as possible without the confusing detail. The war, however, interfered with the carrying out of this plan, which is only now being consummated.

It was assumed at the onset that the nurses would take up the study of obstetrics only near the end of their course, after approximately two years of previous hospital training had familiarized them with the usual nursing procedures. Moreover, it was realized that detailed statements about equipment and methods should be avoided as much as possible, in view of the fact that all hospitals have already adopted the routine which best suits their peculiar requirements. It then became apparent that there was a need for a simplified treatise on the more or less scientific side of the specialty, so that the nurses would have a better background for their practical work. While too much knowledge is sometimes decried as being detrimental to the development of a good "practical" nurse, there can be no question that the individual in any line of endeavor who does things knowingly and thinkingly is superior to the automaton. Nursing itself is constantly rising to a higher plane and progressively more learning will be required of all in the profession. Because of these beliefs, then, concerning the trend of the times, the author has sought to anticipate the nurses' needs and to develop a text which shall be a bit ahead of the present line of advance, thereby, of course, inviting the criticism that the subject matter is altogether too theoretical.

In this connection it should perhaps be stated that we are quite in sympathy with the feeling that a nurse should be primarily qualified by her training to take over the practical care of the sick, but we likewise believe that she is one of the very best mediums by which the public may be educated, and that the latter function justifies the more elaborate programs, which are being developed for her education. The profundity of the ignorance of the laity on medical subjects is quite beyond belief, and yet, the success of our modern campaign in preventive medicine depends largely upon our ability to dispel the clouds of superstition and conjecture. In such a fight, the attainment of the goal depends upon the size and aggressiveness of the attackers, and a well-educated corps of trained nurses who can supplement the efforts of the medical men will be of the greatest assistance. And to be successful in such work, each individual must be equipped with available facts, since conquests of this kind are more frequently determined by conversational than by manual dexterity.

It will be quite apparent to those familiar with the larger work, that the author of the present text has been an associate of Doctor Williams, the author of Williams' "Obstetrics," the standard work for medical students. No apologies are offered, because it is felt that it would be difficult to do better than feebly imitate what has been so successful in the broader field. A textbook is valued for its objective information rather than for the individual views of the author, which are more suitable for publication in a monograph. Doctor Williams, himself, has very graciously helped in all the material selections and has, moreover, thoroughly criticized every chapter. In addition, he has permitted the use of many illustrations, which rank among the best in medical publications.

It is a pleasure to express my thanks to Doctor Williams for his constant help as well as for the drawings. I likewise wish to thank the other authors who have granted permission for the reproduction of their illustrations and to the many others who have, from time to time, been of material assistance in one way or another.

EVERETT D. PLASS

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A TEXTBOOK OF OBSTETRICS FOR NURSES

INTRODUCTORY CHAPTER

Obstetrics[1] is the branch of medical art and science concerned with the problems of child-bearing. In the past its scope has been too frequently limited to the actual delivery of the child, but the present tendency is toward a much broader conception which includes the whole process of reproduction. From this more modern viewpoint the study of Obstetrics divides itself naturally into four phases: *preparation,* the menstrual cycle; *pregnancy* (*gestation*), the development of the ovum within the uterus; *labor* (*parturition, confinement*), the expulsion of the child into the outer world; and *puerperium* (*lying-in period*), the return of the mother to normal.

Menstruation is an evidence of sexual maturity and of potential pregnancy, and an important part of the sexual life of women consists of a succession of menstrual cycles which begin with puberty and end only with the menopause. This normally limits the reproductive period to the thirty years between the ages of fifteen and forty-five. The menstrual flow is only part of the cycle, and from our standpoint the least noteworthy, because the old dictum "a woman menstruates because she does not conceive" still holds good. Pregnancy may occur, as during a period of lactation, without the usual objective evidences of menstruation, but, even here, the more fundamental processes of the complicated menstrual cycle must have occurred. Menstruation is linked by some hidden mechanism to the phenomenon of ovulation, whereby the sex cell of the female is matured and placed in position to meet and combine with the mature male cell, which stimulates it to develop into a mature infant.

Pregnancy, as necessary for the reproduction of the species, is the end toward which the complicated female sexual organism is directed from the time of puberty to the menopause. The normal period of gestation is nine months and, since most women are pregnant more than once during the thirty years of their sexual life, it is apparent that for a considerable portion of her mature life each woman is in the broad sense an obstetrical patient. During gestation the entire resources of the body are mobilized and directed toward the one end—the successful delivery of a healthy full-term infant, who will in his turn help to carry on the human race. The woman is changed bodily and mentally, her metabolism is strikingly altered, she is subject to certain diseases which occur only in the pregnant, and has a relative immunity to certain other maladies. Lack of reasonable care during pregnancy has been the cause of innumerable deaths in the past, but, of recent years, the application of the principles of prophylactic medicine has accomplished much good and has been the greatest single advance in the art since the introduction of aseptic technic and anesthesia. All pregnant women should be under the supervision of a physician who understands the importance of the prenatal care and advice that he can give the prospective mother. Much anxiety, and even actual harm, would be avoided if obstetrical patients were always free to consult a trained individual rather than being forced to rely upon the advice of the older women of the neighborhood who profess to know a great deal, but who, in reality, are absurdly ignorant of the whole subject. Experience, in this case, is not a good teacher, because it is quite too individual and subjective.

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[1] Synonyms: Midwifery, Tokology, Geburtshilfe (German) and L'Obstétrique (French).

Labor is the greatest ordeal in a woman's life, and, from the standpoint of the race, the most important. A successful labor is one that results in a healthy baby and a strong, organically sound mother. The occasion calls for the very best professional skill and care, for the outcome vitally affects two individuals. The disastrously high maternal and fetal mortality formerly so common has been greatly reduced by reason of the introduction of surgical methods and perfected details of treatment, so that, at present, labor is not a particularly dangerous experience.

The puerperium or lying-in period represents the time necessary for the maternal organism to recover from the effects of pregnancy and labor. Ordinarily, after two to four weeks, the patient is permitted to resume her usual occupation, but obstetrical supervision should continue until a somewhat later date. The altered structures require at least six weeks in which to involute to the normal non-pregnant condition, and at the end of that period an examination should be made to enable the physician to form a definite opinion as to just what damage, if any, has been caused by labor.

Pregnancy and Labor, Physiological Processes.—Pregnancy and labor alone make it possible for the human species to perpetuate itself, and they should be regarded as essentially physiological in character. Civilization has added to nature's difficulties here, as elsewhere, and has multiplied the instances where she is apparently at fault, but the safest and wisest policy is to emphasize the conviction that pregnancy and labor are usually normal human physiological phenomena. In many circles the process of reproduction is considered a disease, and this attitude has done much to cloud the minds of the laity. It is pure prudishness, a relic of past centuries, that makes legitimate pregnancy a thing to be concealed and that causes a pregnant woman to shun all except her immediate friends after her condition has become apparent. These tendencies are becoming less marked, and there is a hope that education will soon do away with the false modesty which inspires them.

Relation of Obstetrics to Other Branches.—Every branch of medicine is, at times, dependent upon each of the others, and obstetrics is no exception to the rule. Physiology, pathology and chemistry, among the underlying sciences, have a prominent place in the development of obstetrical knowledge, and, on the clinical side, internal medicine, as well as practically all the specialties, must on occasion come into the foreground.

Clinically, the closest relation is with gynecology. Despite the physiological character of labor, certain conditions may develop during, or after, the event, which interfere with the normal functioning of the genital apparatus, and these furnish a considerable part of the gynecologist's work. The two branches are really one, but, in any event, they should be so correlated, that the patient will receive the maximum of consideration; the obstetrician should strive to leave his patients in as nearly a normal condition as possible in order to obviate the necessity for subsequent gynecological treatment, and the gynecologist, when treating a woman in the child-bearing period, should always consider the obstetrical aspects of any treatment instituted, particularly when it is operative in character.

General Duties of the Nurse.—Before beginning her obstetrical training a nurse should be familiar with general nursing and with the details of good surgical technic. The special aspects of the work must, of course, be learned, but the practical nursing care of obstetrical patients consists largely in the employment of measures previously mastered. This enables the pupil nurse to concentrate upon the new facts with which she must familiarize herself without shirking the essential nursing details. Reasonable curtailment of routine procedures on a maternity service, where nurses are trained, is advocated, because it increases the time available for instruction. Intelligent objective observation of the patient means much to the busy practitioner or house officer, and should be cultivated. Too much stress cannot be laid upon the two fundamental qualities—*cleanliness and patience.*

Dissemination of Knowledge.—At present women are much more reliably informed about the subject of child-bearing than ever before, but a vast amount of education is still necessary and no one can do this better than the nurse who meets her patients in such an intimate association. She should have at her disposal a definite knowledge of facts which can be presented to combat the prevalent superstitions and lay theories, and she should use every opportunity to enlighten those less well informed. The establishment of prenatal clinics in the larger cities has been a great factor in public enlightenment among the poorer classes, and the wealthy woman early seeks the advice of the specialist, but the unfortunate middle class is as usual most in need of instruction and advice.

A BRIEF HISTORICAL SURVEY

It is felt that a brief history of the development of obstetrical knowledge may serve to stimulate interest in the study of the subject, and an attempt has been made to bring together briefly the more outstanding landmarks in the progress of the specialty through the centuries. All detail has of necessity been omitted and much interesting material has been completely ignored. The story as presented will emphasize the fact that all medical knowledge has moved forward together under the influence of a comparatively few revolutionary discoveries, and that obstetricians have no reason to feel that their specialty has not contributed its full share to the general advancement of the healing art.

The beginning of obstetrical history is shrouded in the mists of antiquity, and for centuries there are only occasional glimpses of the procedures employed in normal and complicated child-birth. From the earliest medical writings it is evident that the usual attendants at confinements were women, who had gained special knowledge of the subject by experience and handed it down from one generation to the next, while the physicians were summoned only when the child was dead or the patient *in extremis.* Accordingly, it is not strange that the older writers mention only procedures for the mutilation and extraction of the infant.

It seems that the first operation that had for its purpose the saving of the child's life was the removal of the fetus through an abdominal incision from patients who had died late in pregnancy or at the time of labor. Legend affirms that Julius Cæsar was born in this way and that the operation was thereafter called cesarean section. Certain passages in very early manuscripts appear, however, to prove that the procedure was in vogue centuries before Cæsar's time. In Rome and Venice, during the height of their civilization and power, this method of delivery was demanded by law and a severe penalty was provided for failure to perform it when indicated.

Turning or *Version* was adopted at an early date and aimed at the delivery of a living child from a living mother. It was first mentioned by Celsus in the second century, but at that time was employed only in cases of severe dystocia after all hopes of a spontaneous outcome had been abandoned.

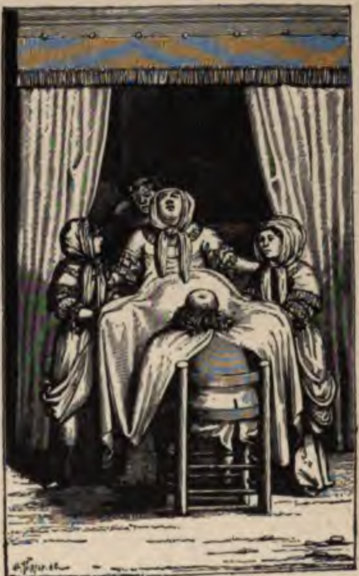

FIG. 1.—The method of draping an obstetrical patient during the latter part of the eighteenth century when a man-midwife was in attendance. (Witkowski.)

In the long centuries that constitute the Dark Ages, no progress was made, and even the older practices were forgotten. Following the sixteenth century Renaissance, there appeared a growing tendency toward objective scientific work, that was soon reflected in the practice of obstetrics. Anatomy was rescued from the fanciful atmosphere that had prevented its advance, and a serious attempt was begun to study the body and its functions as they really are. This search for objective information has continued to the present, so that for the past four centuries there has been a slow but steady advancement of knowledge, which has been particularly rapid during the last fifty years.

Shortly after the printing press was invented by Gutenberg in the middle of the fifteenth century, the publication of medical works began, and as early as 1513 Roesslin's *Der Schwangeren Frauen und Hebammen Rosengarten,* a guide for midwives, appeared as the first treatise exclusively devoted to obstetrics. This and similar early works were based largely upon the inaccurate writings of the ancients, and only gradually did actual observation succeed in eliminating the imaginative features from anatomy, physiology and pathology and pave the way for the later advances in practice.

The great French surgeon, Ambroise Paré, in the middle of the sixteenth century, revived the operation of version, which had fallen into disuse. His pupil, Guillemeau, extended its application and by its use saved the life of his master's daughter when she was in danger of bleeding to death from placenta previa. Paré's book, dated 1579, marked a great advance and was very widely utilized.

FIG. 2.—Ambroise Paré.
(Witkowski.)

The first authentic case of successful cesarean section upon a living woman is accredited to Trautmann, who operated in 1610. From that time the procedure has had a continually increasing sphere of usefulness. Until very recently, however, the maternal mortality was so great that the operation was employed only when other methods of delivery were impossible. Among eighty patients upon whom cesarean section was done in the United States prior to the year 1878 there was a death rate of over fifty per cent, and it was not until 1883 that the operation was successfully performed in Paris or New York City. This appalling mortality was due to hemorrhage and infection, and may be traced to the prevailing ignorance concerning asepsis, as well as to the fact that sutures were not employed to close the uterine wound. In 1876 Porro advocated the removal of the uterus after the child had been delivered and the suturing of the cervix into the lower angle of the abdominal incision. In this way post-partum hemorrhage and puerperal infection were largely avoided and much better results made possible. Shortly afterward, in 1882, Sänger advised suturing of the uterine wound, rather than the removal of the organ, and thereby introduced the last step in the development of the present-day conservative operation. Accumulated experience has resulted in the improvement of the technic of the procedure and has indicated more accurately the conditions under which it should be employed.

The use of hooks and crude forceps armed with sharp teeth in the delivery of children presenting by the head had been practiced from early times, but it was not until the beginning of the seventeenth century that Peter Chamberlen devised a non-mutilating obstetrical forceps. Prior to that time version was the only procedure that could be utilized to deliver a living baby artificially. For four generations the secret was kept in the Chamberlen family, the male members of which practiced medicine and specialized in midwifery. After the invention became public property, about the beginning of the eighteenth century, it was widely adopted, and various improvements appeared from time to time. The only alterations of really fundamental character were the addition of the pelvic curve by Levret (1747) and Smellie (1751) and the development of the axis-traction principle by Tarnier in 1877.

Aside from this progress in operative procedures, the chief advances were in the knowledge of the anatomy and physiology of parturition. Mauriceau, late in the sixteenth century, wrote extensively and emphasized the proper method for delivering the after-coming head in breech presentations. Deventer, early in the eighteenth century, advanced new and more correct ideas about the human pelvis and, a little later, William Hunter, by careful dissections, placed the anatomy of the pelvic organs on a more reasonable basis, while Sir Fielding Ould was largely respon-

FIG. 3.—Mauriceau. (Witkowski.)

sible for the elimination of certain crude conceptions concerning the mechanism of labor. The first truly American advance was the discovery of the properties of ergot by John Stearns in 1807.

All this earlier work was quite essential, but it remained for the nineteenth century to produce the two greatest advances in the field of obstetrics: *Antisepsis* and *Anesthesia.* Credit for the former undoubtedly belongs to Ignaz Semmelweiss, of Vienna (1847), although Oliver Wendell Holmes, in this country, had called the attention to the "contagiousness of puerperal fever," as early as 1843. Semmelweiss not only made the statement that puerperal fever was wound infection, but insisted that the septic material was introduced by the hands and instruments of the attendants. He demonstrated that systematic disinfection of the hands of all physicians, students and midwives, who were treating the patients in the wards of the hospitals, would prevent infection, and the adoption of his recommendations resulted in an immediate drop in the maternal death rate from ten per cent to one per cent. These facts failed utterly to impress the profession at large, and many years elapsed before the doctrine spread even to the larger hospitals, and, even now, one occasionally sees physicians who scoff at the idea. Indeed, the final recognition of the facts emphasized by Semmelweiss was not effected until the etiological connection between certain micro-organisms and wound infection was established with the ultimate development of modern surgical technic.

Sir James Y. Simpson of Edinburgh, Scotland, was the first to administer anesthesia to women in labor (1847). At first he employed ether, but, after he had discovered the anesthetic properties of chloroform a few months later, he preferred its use in obstetrical work. For a time there was great opposition to the idea of relieving labor pains, but after a number of prominent women had enjoyed the blessings of chloroform it became more rapidly popular. Queen Victoria availed herself of its benefits and in consequence the method of producing light obstetrical anesthesia became known as "anesthesia à la reine." In this country, Mrs. Longfellow, wife of the poet, is reputed to have been the first woman to whom chloroform was administered for this purpose.

Within recent years there has been a gradual improvement in the details of treatment, but no epoch-making discoveries have been forthcoming. The past decade has had as its outstanding feature the introduction of systematic prenatal care, the beneficial results of which are already becoming apparent.

CHAPTER I

ANATOMY AND PHYSIOLOGY OF THE FEMALE GENERATIVE ORGANS

The anatomy and physiology of the female generative organs should by quite familiar to the nurse beginning the study of obstetrics, but they will be briefly reviewed, with the emphasis placed upon the structures which are of special obstetrical importance.

The genitalia are designated as *external* and *internal*, according to their location and function; the former embraces the visible structures, the vagina, and, for our purpose, the perineum, while the latter includes the uterus, tubes and ovaries. The structure of the pelvis and the breasts will also be taken up because of the obvious necessity for information as to their anatomy and function.

Obstetrically, the external organs serve merely as a passageway for the fetus and their importance depends largely upon their being prone to lacerations during labor. On the other hand, the internal structures are indispensable; the ovaries furnish the original fetal cell, the ovum, which passes through the fallopian tube to the uterus, whose lining membrane has been prepared for its reception and nutrition. Here the rapidly developing ovum remains for nine months and in the end the hypertrophied muscle of the organ forces it into the outer world as a full-term infant.

THE EXTERNAL GENITALIA AND PERINEUM

The visible external genitalia include the *Labia Majora, Labia Minora, Mons Veneris, Clitoris, Vestibule,* and obstetrically, the *Perineum.* The term *Vulva* is frequently applied to the area occupied by these structures. The *Vagina* is really an intermediate organ, for it serves to connect the external with the internal organs, but its function allies it with the former. The external genital organs furnish the avenue for the introduction of the spermatozoa at coitus and for the passage of the fetus from the birth canal into the outer world at the time of labor.

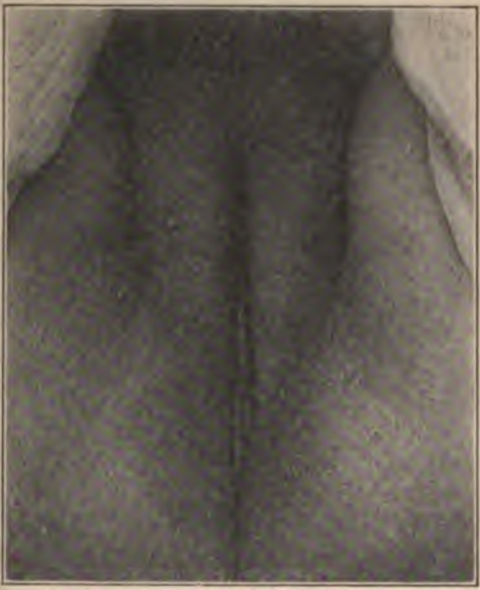

FIG. 4.—The external genitalia of a primigravida—the labia normally in contact.

Mons Veneris.—The Mons Veneris is a thick pad of fat overlying the surface of the symphysis pubis. In the grown woman the skin covering it is abundantly supplied with coarse, crinkly hairs, which occupy a triangular area with its base upward. In the so-called "masculine type" of woman the upper margin is triangular and extends up the mid-line of the abdomen as in the male. This peculiarity is not infrequently associated with other evidence of the "masculine type," such as small conical breasts and a narrow, funnel pelvis.

Labia Majora.—The two rounded masses of tissue which extend downwards from the mons veneris are called the labia majora. They pass to either side of the vestibule and, becoming less pronounced, finally merge into the perineal structure. Externally, they are covered with coarse hair, but their internal surfaces are moist, red and hairless, and resemble the mucous membrane of the mouth in appearance. In nulliparous individuals they are in contact, but after labor they

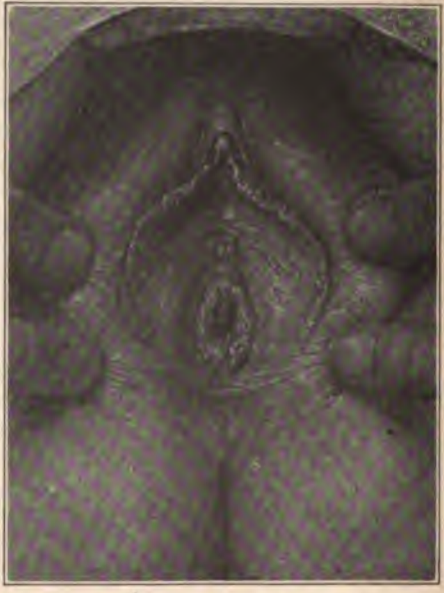

FIG. 5.—The external genitalia of the same patient—the labia separated.

are frequently no longer in apposition and the inner surface develops a horny layer and more nearly resembles skin. The great bulk of these structures is made up of fat with considerable quantities of connective tissue. They have an abundant blood supply but contain no muscle. There are numerous sebaceous glands. The round ligaments of the uterus pass through the inguinal canal (Canal of Nuck) on either side and terminate in the connective tissue of the labia majora.

Labia Minora.—Beneath the labia majora and, in nulliparous women, usually hidden from view, are two delicate, moist, red structures, one on either side, the labia minora. They contain no hair follicles but are supplied with sebaceous and sweat glands and are very vascular. Their upper ends divide into two leaves, which, uniting together above and below the clitoris, form its frenulum and prepuce, while, inferiorly, the two labia gradually fade away and unite to form the fourchette. During labor the labia minora, and very exceptionally the labia majora, may be torn through and give rise to considerable bleeding which is easily controlled by sutures.

Clitoris.—The analogue of the male penis is a small erectile body situated at the upper extremity of the vulva. It is abundantly supplied with nerves, is extremely sensitive and, under the influence of sexual excitement, becomes somewhat enlarged. It has no obstetrical importance.

Vestibule.—The area lying between the labia minora, from the clitoris to the fourchette, is called the *Vestibule.* The urethra, vagina and, on the two sides, the ducts of Bartholin's glands open upon it. These last named structures are small racemose glands about the size of small peas, which are rather deeply placed lateral to the vaginal wall. They secrete a yellowish liquid during sexual excitement. Ordinarily they are not palpable and the openings of their ducts on either side are seen only with difficulty; but occasionally gonococci or other bacteria gain entrance to the glands and lead to abscess formation.

Urethra.—The urethral orifice or meatus is situated in the upper portion of the vestibule, just below the pubic arch. The urethra itself is about two inches in length, follows the anterior vaginal wall and serves as the excretory duct of the bladder. Around the meatus are the ducts from several small glands, Para-urethral or Skene's ducts, which are barely noticeable unless they are infected and inflamed.

Vagina and Hymen.—The inferior or lower portion of the vestibule is largely occupied by the vaginal orifice, which in children and virginal adults is almost completely closed by a diaphragmlike structure, the *hymen.* In early fetal life the vagina is represented by a solid cord of epithelial cells, the core of which degenerates before birth, except at the lower end, where it persists as the hymen. Normally, this is a thin membrane with a small crescentic opening to permit the escape of the menstrual discharge. Very rarely it is imperforate and has to be artificially opened before the menstrual blood can escape. This delicate structure usually ruptures at the first coitus by tearing through to the base in several places. Ordinarily there is a trifling amount of bleeding at this time, but, in rare instances, such profuse hemorrhage may occur that surgical intervention may be necessary to control it. During labor the long tags of hymen are necrosed by the pressure of the advancing head and the small nodules of scar tissue which result are known as *carunculae myrtiformes.*

Vagina.—The vagina forms the connection between the vulva and the uterus, and, as such, its functions are: to drain off the uterine secretions and the menstrual flow; to permit the entrance of the spermatozoa to the uterus by serving as the organ of copulation; and, finally, to allow the passage of the product of conception from the uterus to the outer world. It is a potential tube of great dimensions—large enough to accommodate the fetal head—but ordinarily it is so collapsed upon itself that its walls are in contact. Anteriorly, it is separated from the urethra and bladder by the vesico-vaginal septum and, posteriorly, from the rectum by the perineum, the recto-vaginal septum and the cul-de-sac of Douglas. The canal is curved anteroposteriorly and ends in a dilated pouch into which the cervix of the uterus dips. The pouch around the protruding cervix constitutes the *vaginal fornix,* the posterior depression being deeper than the anterior. In young women the vaginal walls are more or less corrugated in appearance from the presence of numerous small folds called *rugae.* After child-birth these are much less noticeable.

The length of the vagina varies in different individuals, but its posterior wall is always longer than the anterior; 7.0 to 10.0 centimeters (3 to 4 inches) and 6.0 to 8.0 centimeters ($2^1/_2$ to $3^1/_2$ inches) respectively.

The vaginal mucosa resembles skin in that it is composed of many layers of epithelial cells, but the horny layer is missing except in women suffering from prolapse of the pelvic organs, and it contains no hair follicles or glands. It is supported on a connective tissue submucosa by a very loose union which permits the two layers to be readily separated when occasion demands. The true vaginal muscles are small and delicate, but the *levator ani,* one of the perineal muscles, is so placed that it acts admirably as the closer of the vagina.

In non-pregnant individuals the vaginal mucosa is kept moist by a slight secretion from the cervical and uterine glands. During pregnancy this secretion increases in amount and acquires such marked bactericidal properties that it prevents the development of any pathogenic organisms that may be introduced. Certain harmless bacteria flourish in it and may be partly responsible for the destructive action of the secretion upon the dangerous pyogenic organisms. The vaginal secretion is normally acid; the degree of acidity varying continually during the menstrual cycle, and reaching its maximum immediately before the menstrual flow. During pregnancy similar variations in the acidity are observed.

Perineum.—The triangular mass of tissue situated between the vagina and the rectum constitutes the *perineum* or *perineal body*. It is covered by skin and its substance is composed of connective tissue, a considerable part being of the elastic variety, fat, and various bundles of muscle, of which the *transversus perinei* and the *sphincter ani* are obstetrically important. The levator ani muscle lies above the perineum, and, with its attached fascial layers, serves as the pelvic diaphragm, supporting the pelvic viscera; while the sphincter ani closes the lower end of the rectum. Although the perineum is so constituted as to withstand great distention at the time of labor, it frequently happens that it is exposed to such great strain that its tissues partly or completely give way as the child is born. The prompt recognition and repair of such perineal tears is the best assurance against subsequent relaxation with its accompanying symptoms.

THE INTERNAL GENITALIA

Uterus.—The uterus is essentially a muscular organ, whose chief functions are the reception and retention of the fertilized ovum until maturity, and finally the expulsion of the fetus at the time of labor. The menstrual flow periodically proceeds from the uterus when there is no fertilized ovum to become implanted upon the lining membrane, which has been carefully prepared for it during the premenstrual period.

The uterus is a pear-shaped organ, which consists of two portions, the *cervix* and the *body*. The former projects into the upper end of the vagina and is pierced by a fusiform passage, the cervical canal, which terminates at its free end by the *external os* or *"mouth of the womb,"* and at its upper end by the *internal os,* which forms the communication with the cavity of the body. The relation between cervix and body varies according to the age of the woman and whether or not she has borne children. In young girls, the cervix is twice as long as the body; in mature nulliparous women the two are about equal in length; whereas in parous women the body is twice as long as the cervix. The length of the entire uterus, body and cervix varies likewise; the infantile organ is 2.5 to 3.0 centimeters (1 to $1^{1}/_{5}$ inches), and the mature nulliparous organ 5.5 to 8.0 centimeters ($2^{1}/_{5}$ to $3^{1}/_{5}$ inches) long, compared with 9.0 to 9.5 centimeters ($3^{3}/_{5}$ to $3^{4}/_{5}$ inches) in the multiparous individual. The nulliparous organ weighs about 40 grams ($1^{1}/_{3}$ ounces) and never regains its original weight after child-birth, when it weighs 60 to 70 grams (2 to $2^{1}/_{3}$ ounces).

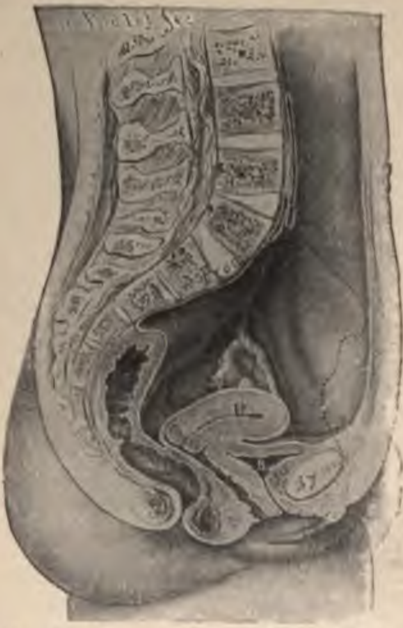

FIG. 6.—Sagittal section through body of adult woman. (Williams after Kelly.)

In the non-pregnant state, the uterus is a pelvic organ, which is freely movable within the pelvic cavity, where it is held in position by various ligaments. It is roughly pear-shaped, the cervix corresponding to the stem end. The anterior surface of the cervix and lower part of the body are in apposition with the bladder, while the remainder of the body is covered with peritoneum except at its sides where the broad ligaments are attached. These triangular structures with the base down, furnish its chief support. At their upper margins are the fallopian tubes or oviducts, and just below and anterior to them the round liga-

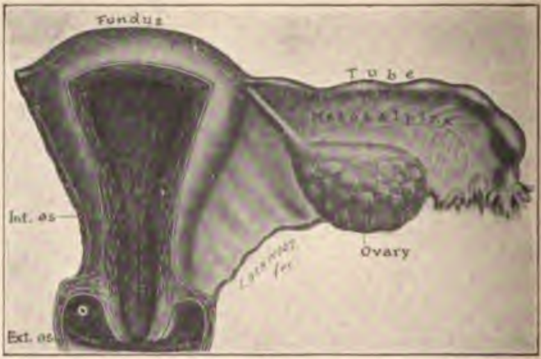

FIG. 7.—Uterus and appendages of a twenty-year-old multipara—posterior view. (Williams.)

ments, one on either side. Through the broad ligaments the blood vessels and nerves pass to and from the uterus.

The cervix and body are quite different in structure and must be described separately.

Cervix.—The cervix is the lower cylindrical portion of the uterus, whose lowermost end projects into the vagina. It is ordinarily about 3.0 centimeters ($1^1/_5$ inches) long and 1 to 2 centimeters ($^2/_5$ to $^4/_5$ inch) in diameter. The cervical canal is a fusiform channel which is constricted at its two extremities to form the external os and the internal os. The former is palpable on vaginal examination and in the nulliparous woman feels like a small dimple, but child-birth almost uniformly results in slight lacerations which lengthen the dimple transversely, so that it normally becomes converted into a transverse slit whose presence furnishes excellent evidence of a previous labor, provided instrumental dilatation of the cervix can be excluded. Occasionally, the lacerations are deeper and the external os becomes an irregular-shaped, stellate opening.

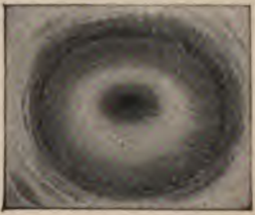

FIG. 8.—External os of cervix before child-bearing. (Williams.)

The vaginal portion of the cervix is covered by stratified epithelium which is continuous with that lining the vagina, while the cervical canal is lined with a mucosa consisting of a single layer of high columnar cells which, abruptly at the external os, are replaced by the many-layered epithelium of the vagina, and, at the internal os, give way to the more cuboidal cells of the uterine mucosa. This layer of cells dips down into the stroma to form the compound cervical glands which secrete an alkaline mucus. When the ducts of these glands become occluded through injury or disease, small retention cysts may be formed. These frequently shimmer through the vaginal mucosa and appear as shiny white nodules called *nabothian follicles*. Beneath the mucosa the cervix is made up of connective tissue with many elastic fibers and non-striated involuntary muscle.

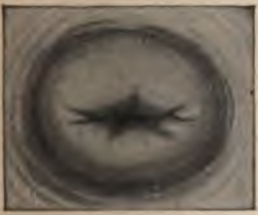

FIG. 9.—External os of cervix showing lacerations after child-birth. (Williams.)

Body of the Uterus.—The main upper portion of the uterus is roughly triangular in shape, when viewed from in front, and flattened from before backward. Its greatest width is between the two cornua where the fallopian tubes enter. The anterior surface is quite flat but the posterior is somewhat convex. The rounded portion at the top between the cornua is called the *fundus*. The uterine cavity is triangular in shape and is more potential than real, because the anterior and posterior walls are normally in contact; so that, strictly speaking, it scarcely exists, unless distended. From within out the wall of the uterus is made up of endometrium, muscle and peritoneum.

Endometrium.—This thin mucous membrane lines the entire cavity from the internal os upwards, except at two minute points where the tubes enter. It is in a state of continual change incident to the menstrual cycle and normally may vary from 1. to 5. or 6. millimeters ($^1/_{25}$ to $^1/_5$ inch) in thickness, depending upon the near approach of the menstrual period. The resting or intermenstrual stage is best described as normal and the various changes occurring during the menstrual cycle may be regarded as variations from this standard.

Its surface is covered by a single layer of small columnar epithelial cells, part of which produce a thin alkaline secretion, while the remainder are provided with small hairlike processes, known as cilia, which maintain a constant current from above downward toward the cervix. Beneath this, the endometrium is made up of a number of layers of other cells —the interglandular tissue—probably of connective tissue origin. These cells increase in size during the premenstrual period, so that the greater thickness of the endometrium at that time is due largely to this phenomenon. This layer is quite vascular and is broken up by the uterine glands, which develop from invaginations of the surface epithelium. During the resting period these glands resemble simple tubes in shape and are lined with cells, exactly like those on the surface; but, during the period of premenstrual swelling, they become much larger and more complicated in structure. They extend as far as, and occasionally penetrate, a short distance into the muscular tissue beneath.

In infants, the glands are very few and shallow, but rapidly increase in number and size as puberty is approached. During the years of active sexual life, together with the rest of the endometrium, they are regularly changing in size and appearance as one menstrual cycle follows another. Pregnancy causes a still greater change, and finally, with the approach of the menopause, the endometrium atrophies and the glands in great part disappear.

Muscle and Peritoneum.—The great bulk of the uterus is made up of involuntary muscle fibers supported by connective and elastic tissue.

During infancy the fibers are quite simply arranged, but, after puberty, the arrangement becomes extremely complicated. Pregnancy is accompanied by a hypertrophy of the existing fibers and by the formation of some new elements.

The peritoneal covering is merely a continuation of the general lining of the abdominal and pelvic cavities, which has been reflected over the body of the uterus wherever it is free in the pelvic cavity. The underlying muscle is only loosely connected to it and, at operation, a line of cleavage is easily located. When the uterus increases rapidly in size, in the latter part of pregnancy, the peritoneum readily stretches and is not placed under any great tension. Following delivery, the return to normal is very rapid.

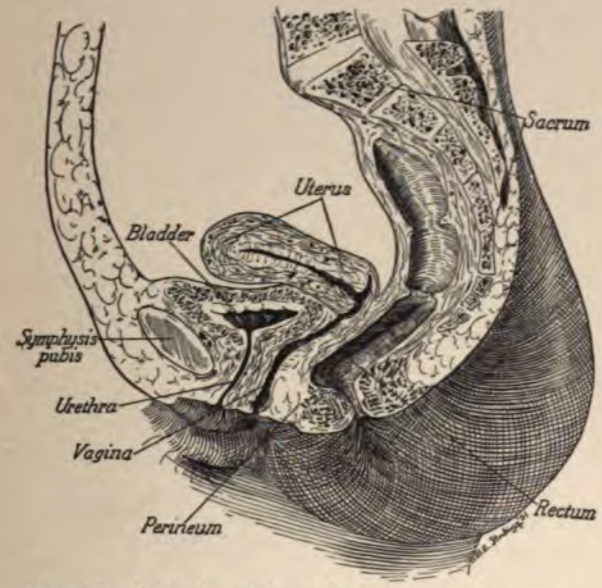

FIG. 10.—Normal position of the non-pregnant uterus.

Position of the Uterus.—The uterus is normally held in a position of slight anteversion and anteflexion. When a woman stands erect the organ is nearly horizontal with the fundus pressing slightly against the bladder in front and the cervix pointing backward toward the sacrum. The axis of the uterus normally meets that of the vagina at approximately a right angle and is slightly concave anteriorly, while in uterine displacements this relation between the axis of the uterus and that of the vagina is altered. In anteflexion, for example, the body of the uterus is sharply bent upon the cervix so that the curvature is exaggerated and its fundus occupies a lower position than normal; whereas in retroflexion the uterus is rotated in the opposite direction so that its fundus comes to lie in the hollow of the sacrum, while the cervix is displaced upward and forward. Of these malpositions retroflexion is the most frequent and important, as it not only by itself gives symptoms, but predisposes to the production of various degrees of prolapse of the uterus.

The normal position of the uterus is apparently maintained by several factors, most important of which are the action of the uterine ligaments and the pressure of the nearby organs. The uterus, and more particularly its body, are quite freely movable and its position may be disturbed even by a distended bladder or rectum, but the normal position is at once regained when the distention is relieved.

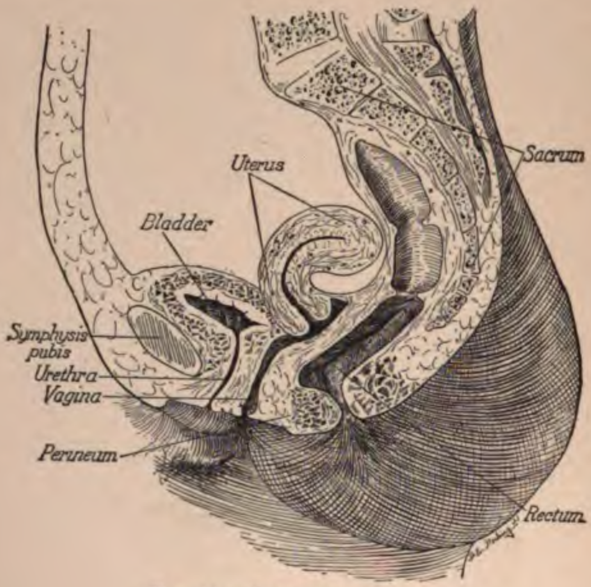

Fig. 11.—Retroverted uterus.

Uterine Ligaments.—These are arranged in pairs, three on either side, namely, the *broad ligaments,* the *round ligaments* and the *utero-sacral ligaments.* The broad ligaments extend from the lateral pelvic walls toward the mid-line and become incorporated into the body of the uterus and supravaginal portion of the cervix. They divide the lower part of the pelvic cavity into an anterior and posterior compartment. They are covered by peritoneum except at their bases, and in their upper part are so thin as to be almost transparent. The narrow upper margin is occupied by the tube for two-thirds the distance from the uterus to the pelvic wall, while the outer third forms the *suspensory ligament of the ovary*—the *infundibulo-pelvic ligament*—through which pass the ovarian vessels. The thin portion of the broad ligament just below the tube is known as the *meso-salpinx*. It contains a rudimentary tubular organ, the *parovarium* or *epoöphoron,* which constitutes a remnant of important fetal organs. Occasionally, cysts develop from its tubular ducts, and may interfere with labor by obstructing the passage of the child through the pelvis. At the base, opposite the supravaginal portion of the cervix, the broad ligament is much thicker and is composed of a few muscle fibers and large blood vessels. It is here called the *parametrium*. Slightly below the tube and on the anterior surface is the round ligament, quite separate in structure but encased in the peritoneal folds of the broad ligament.

Round Ligaments.—The round ligaments arise from the anterior walls of the uterus, just below the cornua and pass outward through the anterior sheath of the broad ligaments, and then through the inguinal canals to end among the connective tissue of the labia majora. They are composed of smooth muscle which is continuous with that of the uterus and some supporting connective tissue. In the non-pregnant condition these structures are only 3.0 to 5.0 millimeters ($^1/_8$ to $^1/_5$ inch) in diameter and ordinarily are not palpable, but during pregnancy they hypertrophy and when the uterus becomes an abdominal organ they can be readily felt on external examination especially during periods of active contraction.

Utero-Sacral Ligaments.—The utero-sacral ligaments extend from the upper and posterior portion of the cervix to the pelvic wall and are attached over the middle of the sacrum. By maintaining the cervix in the posterior section of the pelvic cavity they assist materially in maintaining the normal position of the uterus. Composed of muscle and connective tissue and covered with peritoneum, they divide the lower posterior pelvic cavity vertically into three sectors, the central one being designated the *cul-de-sac of Douglas.*

Blood Supply of the Uterus.—The uterine and ovarian vessels supply the uterus. The former spring from the hypogastric branches of the internal iliac arteries and pass through the bases of the broad ligaments to the uterus at the level of the internal os. Here they divide, the smaller branches turning downward to supply the vaginal portion of the cervix and the upper portion of the vagina, while the larger pass upward along the lateral margins of the uterus giving off branches as they go and finally each divides into three main stems, the *fundal* supplying the fundus, the *tubal* going outward to the tubes and the *ovarian* anastomosing with the ovarian arteries. These latter vessels arise from the aorta and pass through the infundibulo-pelvic ligaments to the ovarian regions where branches are given off for the supply of those organs and thence proceed toward the uterus to join the ovarian branches of the uterine arteries. The vessels from the two sides anastomose quite freely, although no large branches pass from one side to the other. It is seen that the uterus is particularly well supplied with blood, even in the non-pregnant condition, but during pregnancy all the vessels undergo marked hypertrophy to the end that the fetus through the placenta can readily be supplied with food and can easily eliminate its waste products. The veins in general follow the same course as the arteries.

Fallopian Tubes.—The chief function of the fallopian tubes or oviducts is the transmission of ova from the ovaries to the uterus. Each tube is from 8 to 14 centimeters (3 to 5 inches) in length and extends from the cornu of the uterus out along the upper margin of the broad ligament to the region of the ovary. They are essentially muscular tubes with an epithelial lining, and in shape somewhat resemble horns with the smaller ends within the uterus and the larger ends terminating freely by irregular funnel-shaped openings—the *fimbriated extremities.* Normally their course is quite tortuous but when pulled upward by the growing pregnant uterus the convolutions disappear. The uterine end is scarcely visible from the uterine cavity, but microscopically it has the same structure as the larger portions.

The lining epithelium is of high columnar cells somewhat similar to those of the uterine epithelium, partly ciliated and partly secretory in function. The epithelium rests upon connective tissue, which at the uterine ends is arranged in four folds so that the lumen has roughly the shape of a cross, while, laterally, it becomes much more complicated in structure. The muscle layers, longitudinal and circular, make up the rest of the body of the organ, which is covered by peritoneum except at its attachment to the meso-salpinx. As the ovarian end of the tube is approached its diameter increases and its mucosa becomes vastly more complicated by the arborescence of the original four folds which now practically fill the enlarged lumen. Near the ovary, the tube ends in a wide expansion with dentated edges—the fimbriated extremity—and one of the fimbriae extends almost or quite to the ovary. Both the ovary and the end of the tube are free in the pelvic cavity, so that the ovum when set free from the ovary is wafted toward the tubal entrance by the current set up in the capillary layer of peritoneal fluid by the cilia at the fimbriated extremity of the tube. Abnormalities in development and changes due to disease may so decrease the diameter of the tube as to give rise to the cases of tubal pregnancy which are occasionally seen.

Ovaries.—The ovaries are two small, flattened, almond-shaped organs attached to the posterior surface of the broad ligament by the mesovarium, a fold of peritoneum-covered connective tissue. They vary considerably in size, but average about 4. centimeters ($1^3/_5$ inches) in length, 2.5 centimeters (1 inch) in breadth and 1.25 centimeters ($^1/_2$ inch) in thickness. At the point of attachment to the mesovarium they are covered by peritoneum, but the greater part of their surface is free and is covered by a layer of cuboidal cells, the *ovarian epithelium*. In early life, the surface of the ovaries is smooth, with a few clear vesicles of varying size—the *graafian follicles*—shimmering through the epithelial covering, but later, and especially after the menopause, it becomes markedly roughened and convoluted.

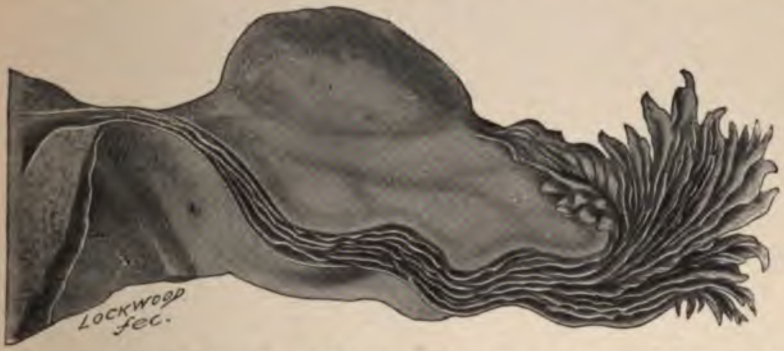

FIG. 12.—Longitudinal section of fallopian tube, showing increasing complexity of folds. (Williams after Sappey.)

When an ovary is cut through, it is seen to be composed of a core of very vascular connective tissue, the *medulla*, about which is arranged the active gland tissue, the *cortex*, which contains graafian follicles in all stages of development. The cortex is thicker in young women and diminishes gradually as old age is approached.

Microscopically, the interesting structure is the primordial follicle which develops into the graafian follicle. This in turn gives way to the corpus luteum. At birth, the cortex is filled with primordial follicles, 40,000 to 50,000 in each ovary, but before puberty more than half of them have disappeared, and, of those that remain, only a small percentage ever develop into mature graafian follicles. The ovary of the infant is filled with primordial follicles, which consist of a large clear cell—the ovum—surrounded by a single layer of epithelium and held together in a connective tissue stroma; but with the advent of sexual maturity the stroma has greatly increased at the expense of the cortex and certain of the primordial follicles begin to develop. From the thousands of primordial follicles one usually develops during each menstrual cycle so that in a woman's entire sexual life not more than three or four hundred reach maturity, the others vanishing gradually, until, after the menopause, they have entirely disappeared. No new follicles make their appearance after birth.

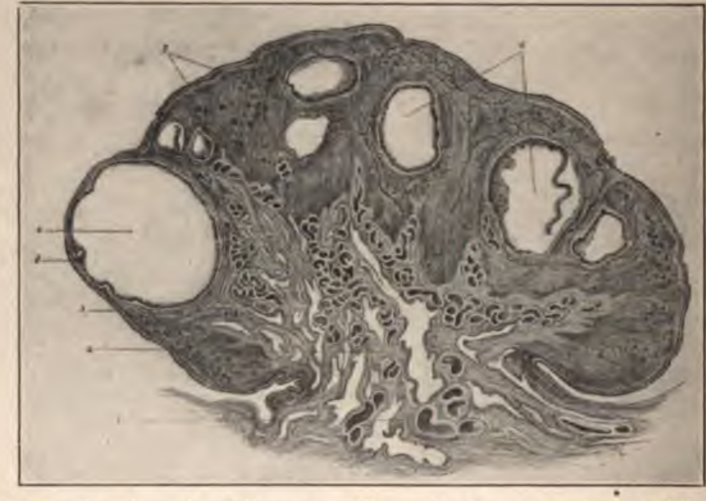

FIG. 13.—Section through adult ovary. (Bumm.) (1, mesovarium; 2, hilum with large vessels; 3, ovarian or germinal epithelium; 4, nearly ripe follicle; 5, primordial follicles; 6, developing graafian follicles; 8, Discus proligerus with contained ovum.)

From birth until the end of sexual life, primordial follicles are constantly developing, but until puberty the development takes place near the center of the ovary and such ova never fully mature. The first evidence of development is a proliferation of the epithelial cells surrounding the primordial ovum. After this layer has become many cells thick, the internal cells degenerate and the space is filled with liquid (*liquor folliculi*). Shortly afterwards the ovum is pushed to one side of the cavity where it is surrounded by a mass of epithelial cells—the *discus proligerus*. The other epithelial cells surrounding the cavity of the follicle are known as the *membrana granulosa*, while the connective tissue cells just beyond form part of the wall of the follicle, which is known as the *theca folliculi*. After the primordial follicle has begun to develop and has attained a certain size it is designated as the *graafian follicle*.

The fate of the graafian follicle depends largely upon the location in which it develops. In childhood, and occasionally during adult life, the development takes place deep in the ovary where by no possible chance can the ovum be extruded into the peritoneal cavity. In this situation, after a varying degree of growth, the ovum perishes and nature promptly takes measures to eliminate the follicle, the process being designated as *follicular atresia*. The ovum first dies and is absorbed, the membrana granulosa then separates from the theca and degenerates, while the liquor folliculi is absorbed. The cavity of the follicle then collapses and the cells of the theca proliferate to fill in what remains of it and develop a yellow pigment called *lutein*—the cells are now known as *lutein cells*. This is soon accomplished, and the lutein cells are in turn invaded by the surrounding connective tissue, so that, eventually, all trace of the follicle disappears, and in young individuals, strangely enough, no scar tissue remains to mark its location.

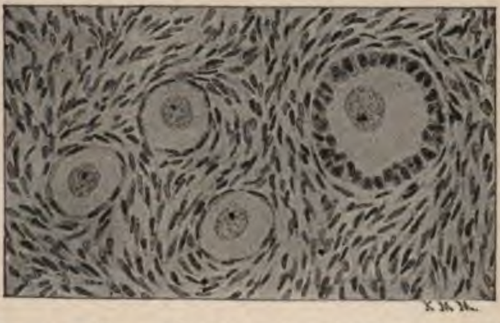

FIG. 14.—Ovary showing primordial follicle (left) and follicle just beginning to develop (right). (Williams.)

During sexual life certain follicles nearer the surface of the ovary are destined for further development and their fate is quite different. As they increase in size they approach the surface and the inclosed ovum undergoes the first of the changes which make it mature and capable of being fertilized. The growth is similar in nature to that observed in the deeper follicles, but continues far beyond the stage at which atresia ordinarily occurs. A mature graafian follicle is about 1.25 centimeters ($^1/_2$ inch) in diameter and protrudes from the surface of the ovary as a shiny clear cyst. At its summit the wall becomes weakened because of an impaired blood supply and in time ruptures, expelling the ovum and the liquor folliculi into the pelvic cavity. The resulting hole in the ovary is quickly filled with blood oozing from the torn vessels and the process of healing has commenced. The clot is absorbed by the rapidly growing lutein cells from the theca interna and a *corpus luteum* is formed. If the ovum which has been set free is fertilized and pregnancy ensues, the corpus luteum increases in size and persists until after labor; but if fertilization does not take place the corpus luteum rapidly disappears, being replaced by the connective tissue cells from the outside. In older individuals, where the circulation is not so active, the degenerated tissues are not absorbed, but become homogeneous and hyalinized to form *corpora fibrosa.* These are slowly invaded and broken up into smaller masses and eventually disappear, a slight thickening of the connective tissue marking their original site.

The formation and final absorption of the corpus luteum is nature's special mechanism for avoiding the production of scar tissue, which is the outcome of similar destructive processes elsewhere in the body. It has been estimated that if the numerous corpora lutea and atretic follicles healed in the usual way, the ovaries would completely fill the abdominal cavity before the menopause was reached. As it is, these organs do not increase in size during the period of active functioning and actually become somewhat smaller after the menopause.

The Function of the Ovary.—The ovaries are glands of both external and internal secretion and in consequence have complicated duties to perform in the economy of the body. The secretion which is designated as external is the ovum or female sex cell which is extruded from the organ and passes into the fallopian tube where it may or may not be fertilized. If unfertilized, the effort is wasted and the ovum quickly dies and disappears; but if it is activated by the entrance of a spermatozoön, the male sex cell, it begins to develop and eventually enters the world as a living child.

This function of the ovary is easily understood, but the internal secretory action is far more complicated, and, even after half a century of observation and research, much yet remains to be learned. After birth the ovary remains relatively quiescent until the approach of puberty, when it rapidly develops and by its internal secretion inaugurates the series of changes so characteristic of this period of life.

We do not know what stimulus is responsible for this increase in ovarian activity, but it has been well established that it causes the transformation of the child into the woman. Some chemical substance produced in the ovary passes into the blood stream and produces various changes in widely separated parts of the body. The genital organs lose their infantile character and become fully developed, menstruation makes its appearance and the girl becomes conscious of her sex. The breasts fill out and the nipples become more prominent, the axillary and pubic hairs appear, the pelvis becomes typically feminine in type and the body generally is rounded out into the fullness of maturity. Once these conditions have been established, the organism begins a series of cyclic monthly changes which terminate only when the menopause has put an end to sexual activity, as mysteriously as puberty instituted it.

The menstrual cycle is dependent upon the internal secretion of the ovaries and the removal of these organs promptly produces an artificial menopause.

The secretory activity of the ovary will be more fully discussed in a later chapter when menstruation is considered.

The breasts and the pelvis are the only other structures whose anatomy and function especially enter into the study of obstetrics, and they will be considered in this place.

Breasts.—In children before the age of puberty the sexes cannot be differentiated by the appearance of the breasts, but at the beginning of sexual life these organs in the female suddenly proceed to full development, whereas the male breasts remain rudimentary throughout life. The breasts lie on the anterior surface of the chest wall between the third and sixth ribs and show marked individual variations in size and consistency. In young girls they are usually firm and conical, but in later years tend to become larger and more pendulous. The center of the convexity of each gland is marked by a slight elevation, the *nipple,* which is surrounded by a pigmented area of skin about 2 to 5 centimeters ($^4/_5$ to 2 inches) in diameter, the *areola.*

The *mammary glands* are concealed in the substance of the breasts. Each gland is composed of fifteen to twenty-five lobes, each having a separate excretory duct opening upon the nipple. The lobes in turn are made up of numerous smaller lobules. During pregnancy the glands increase considerably in size and secrete a thin yellowish fluid, *colostrum,* which, after labor, is replaced by milk.

The nipple is normally quite small and flat but it is an erectile organ and upon stimulation becomes larger and more protruding. The nipples present an irregular surface, and somewhat resemble a mulberry in appearance, with the milk ducts opening in the depressions between the various nodulations. The areolar tissues contain many small sebaceous glands, *Montgomery's* or *areolar glands,* showing as slight protrusions on the surface. During pregnancy the nipples become more prominent and the areolae increase in diameter and darken in color. Among women with a dark complexion the increased pigmentation is more marked than among blondes.

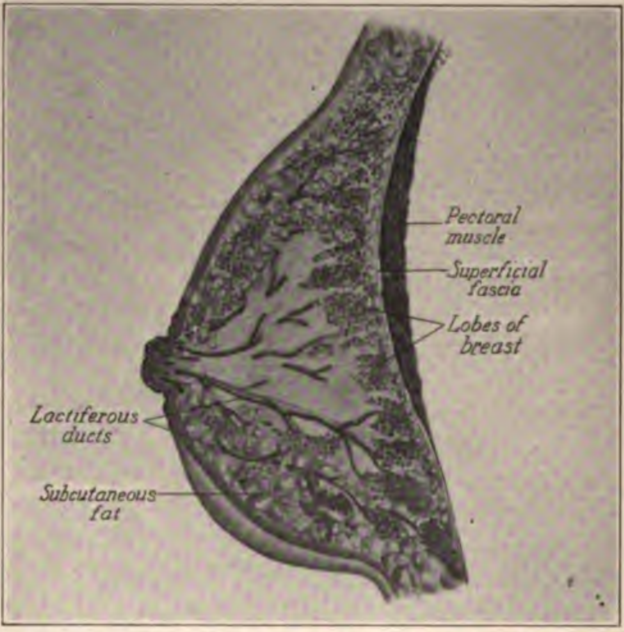

FIG. 15.—Sagittal sections through adult breast. Diagrammatic.

The female breasts represent the second pair of glands in the lower animals. Rudiments of the first pair sometimes occur in the anterior portion of the axillae. These accessory breasts are usually without nipples and are not recognized until after delivery, when they fill synchronously with the regular breasts and become hard and painful. Remnants of the lower pairs of glands may at times be encountered particularly as small symmetrically placed nipples situated in the mammary line on the lower chest wall or on the abdomen.

Pelvis.—The fact that the child during the process of birth must pass through the pelvis explains the emphasis that is laid upon this part of the skeleton. Birth is a series of accommodations between the child and the birth canal and to understand the mechanism of labor with its problems one must be familiar with the unyielding portion of the birth passage, the bony pelvis. Obstetrically, the size of the pelvis, as shown by its various diameters, is of first importance, while its general conformation helps to elucidate the mechanism of labor.

The bony pelvis is composed of four bones; the sacrum, and the coccyx, posteriorly, and the two innominate bones anteriorly and laterally. These last are united in front at the symphysis pubis and posteriorly each of them articulates with the sacrum through a sacro-iliac synchondrosis. The *linea terminalis* is the ridge of bone that passes around on both sides from the promontory of the sacrum to the upper margin of the symphysis pubis. That portion of the cavity above this line constitutes the *false pelvis*. It has no obstetrical importance. The flaring iliac bones help support the abdominal viscera and, in the latter part of pregnancy, the enlarged uterus rests upon them.

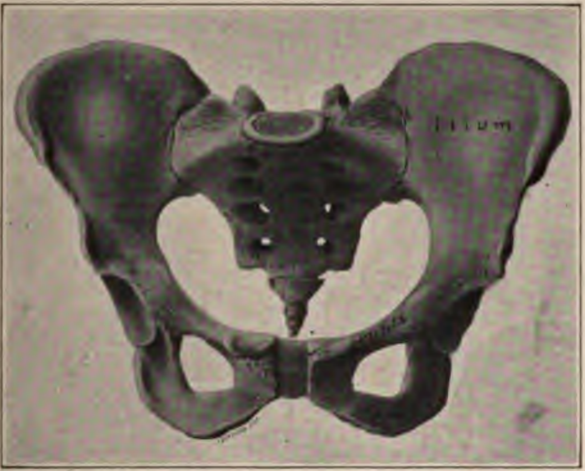

Fig. 16.—Normal female pelvis. (Williams.)

The *true pelvis* lies below the linea terminalis and constitutes the bony framework of the birth canal. The entrance to this passage from above is called the *superior strait* or the *pelvic inlet*. The posterior wall of the true pelvis is formed by the sacrum and coccyx, and, following the curvatures, measures 10 centimeters (4 inches) in height, whereas the anterior wall, formed by the symphysis and the pubic and ischial portions of the innominate bones is only 5 centimeters (2 inches) high. The lateral walls are in part ligamentous.

The superior strait is bounded by the promontory of the sacrum, the linea terminalis and the upper margins of the pubic bones and the symphysis. It is bluntly heart-shaped, the promontory representing the notch of the conventional design. Four diameters are noted, none of which can be directly measured in the living woman. The ***conjugata vera*** or antero posterior diameter of the inlet extends from the center of the promontory of the sacrum to the top of the symphysis. The ***transverse diameter*** is measured perpendicularly to the conjugata vera at the widest portion of the inlet, and the ***right and left oblique diameters*** extend from the corresponding sacro-iliac synchondroses to the opposite iliopectineal eminences in front. The usual measurements are: conjugata vera, 11 centimeters ($4^2/_5$ inches); transverse diameter, 13.5 centimeters ($5^2/_5$ inches) and the oblique diameters, 12.75 centimeters ($5^1/_5$ inches). The conjugata vera is therefore the shortest diameter of the inlet, and when it is shortened in abnormal pelves, may seriously interfere with the course of labor.

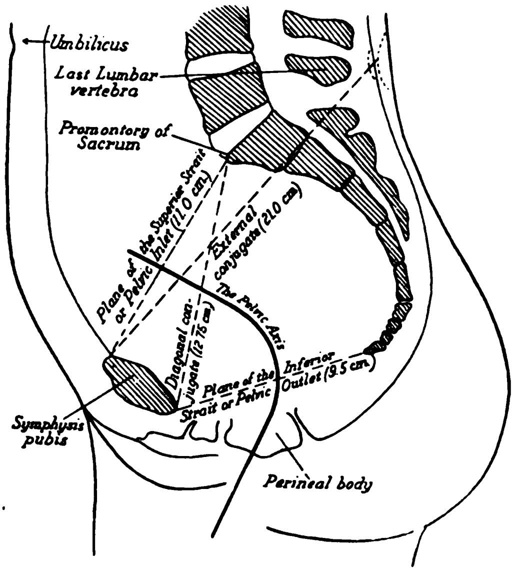
Umbilicus
Last Lumbar vertebra
Promontory of Sacrum
Plane of the Superior Strait or Pelvic Inlet (11.0 cm.)
External conjugate (21.0 cm)
The Pelvic Axis
Diagonal conjugate (12.75 cm)
Plane of the Inferior Strait or Pelvic Outlet (9.5 cm.)
Symphysis pubis
Perineal body

FIG. 17.—Sagittal section through normal pelvis, showing planes and diameters.

In many patients it is possible to palpate the promontory of the sacrum during vaginal examination and to measure quite accurately its distance from the lower margin of the symphysis by marking off with the finger of the free hand the point where the symphysis inpinges upon the examining fingers. After the examining hand has been withdrawn the distance is measured directly and is designated the *diagonal conjugate.* Normally the measurement is 12.5 to 13.0 centimeters (5 to $5^1/_5$ inches) or 1.5 to 2.0 centimeters ($^3/_5$ to $^4/_5$ inch) greater than the true conjugate. In practice the latter measurement is estimated by substracting 2.0 centimeters from the determined diagonal conjugate.

The *plane of the inferior strait* or the *pelvic outlet* forms the lower end of the birth canal. It occupies the area between the ischial tuberosities on the two sides, the lower margin of the symphysis anteriorly and the tip of the coccyx posteriorly. The distance between the inner sides of the ischial tuberosities is designated the *transverse diameter* and measures normally 11.0 centimeters ($4^2/_5$ inches). The *antero-posterior* diameter extends from the lower margin of the symphysis to the tip of the coccyx; this distance is usually 9.5 centimeters ($3^4/_5$ inches), but when the coccyx is pushed back by the head during labor, the available diameter is increased to 11.5 ($4^3/_5$ inches). These measurements are directly obtainable without inconveniencing the patient.

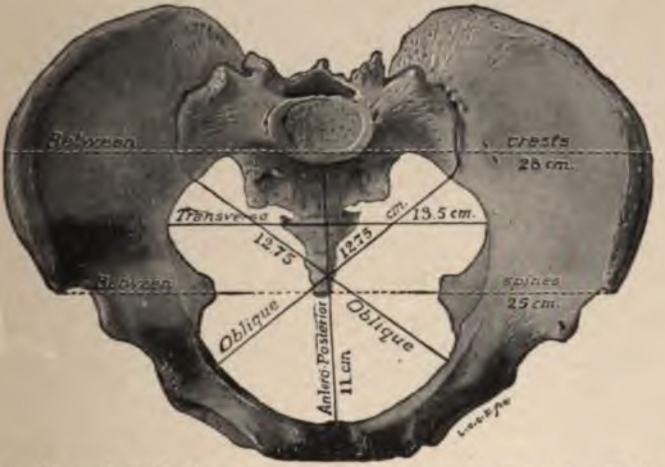

FIG. 18.—Normal pelvis showing diameters of the superior strait. (Williams.)

Many other planes and lines have been described, but a discussion of such less essential details is beyond the scope of this work.

Pelvimetry.—For practical purposes certain measurements of the pelvis are advisable before labor so that the obstetrician may recognize the abnormally small pelvis in time to institute proper measures for delivery. The instruments employed are called *pelvimeters;* innumerable types are in use, but the underlying principle of the calipers is the basis for practically all of them. The width of the pelvis is estimated by taking the distance between the outer surfaces of the anterior superior spines of the iliac bones—the *interspinous diameter*—and that between the widest expanse of the crests of the same bone—the *intercristal diameter.* The former normally measures 26.0 centimeters ($10^{2}/_{5}$ inches) and the latter 29.0 centimeters ($11^{3}/_{5}$ inches). The antero-posterior diameter of the inlet can be roughly gauged by taking the distance between the depression beneath the spine of the last lumbar vertebra and the upper outer margin of the symphysis—the *external conjugate* or *Baudelocque's diameter.* Normally it measures 21.0 centimeters ($8^{2}/_{5}$ inches), but if it falls below 18.0 centimeters ($7^{1}/_{5}$ inches) there is a probability that the conjugata vera may be shortened sufficiently to interfere with labor.

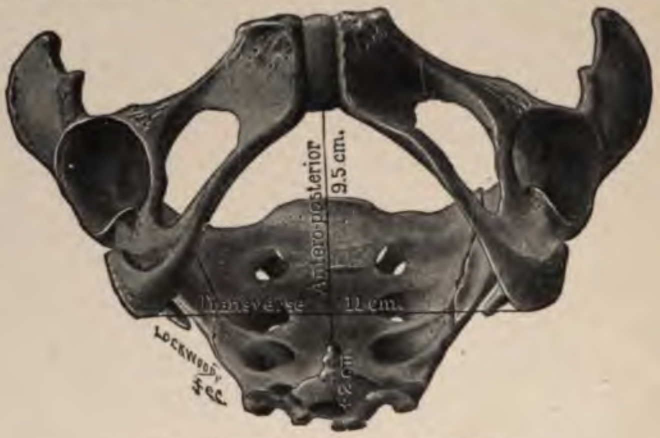

FIG. 19.—Pelvic outlet. (Williams.)

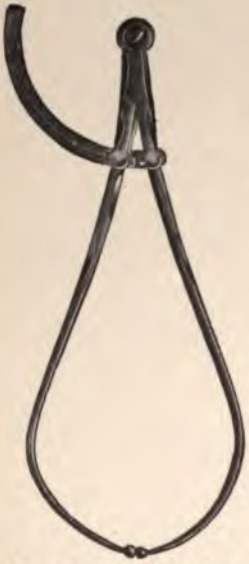

FIG. 20.—Martin pelvimeter. (Williams.)

The *oblique diameters,* between the posterior superior spine of the ilium on one side and the anterior superior spine on the opposite side are sometimes measured routinely. The *right oblique diameter* begins at the right posterior superior spine and is usually slightly longer than the left. The normal measurement is given as 22.0 centimeters ($8^{4}/_{5}$ inches). Intertrochanteric measurements are likewise made between the greater trochanters of the femora, the normal distance being 32.0 centimeters ($12^{4}/_{5}$ inches). These last two diameters are really of little value and are falling into disuse.

Thorough pelvimetry at present also includes the measurement of the *transverse diameter of the outlet.* Shortening of this distance below 8.0 centimeters ($3^1/_5$ inches) interferes with the normal course of labor and occasionally causes serious difficulty.

The Pelvic Joints.—The symphysis pubis is the cartilaginous bond between the anterior extremities of the pubic portions of the innominate bones. Further support is given the joint by the pubic ligaments. Normally, practically no movement is permitted in the joint, but during pregnancy the cartilage is seemingly less dense and limited motion can be appreciated, but has no practical significance.

The *sacro-iliac synchondroses* are true joints in which limited motion can always be obtained. Pregnancy somewhat increases the range of motility. If a patient be placed with the buttocks on the edge of a table or bed and the feet and legs hanging down—the *Walcher position*—the innominate bones rotate slightly on the sacrum and the conjugata vera is appreciably increased, whereas the anteroposterior diameter of the outlet is diminished. Conversely, if the patient's thighs are sharply flexed against the abdomen—the *exaggerated lithotomy position*—the opposite effect is produced, the conjugata vera is shortened and the anteroposterior diameter of the outlet is increased. These facts are utilized in the treatment of contracted pelvis and will be discussed later.

CHAPTER II

MENSTRUATION, OVULATION, FERTILIZATION, MATURATION AND HEREDITY

Menstruation.—From the time of puberty until the menopause the human female organism is constantly undergoing a series of changes, which culminate about every four weeks in the appearance of a discharge of blood from the vagina—the menstrual flow. This objective phenomenon is generally accompanied by subjective symptoms of varying character and intensity, although a small percentage of women are free from such disturbances and are in no way affected by menstruation. Despite the fact that a woman may be conscious of a difference in her feelings for only a few days near the flow, it is generally recognized that during the entire four weeks there is in progress a definite cycle of changes. This curve is represented as in Fig. 21, the crest of the curve indicating the flood point of the life processes and the trough the ebb. Temperature, pulse and blood pressure follow this curve quite closely and the general metabolism shows the same tendency. For convenience we designate the five to seven days succeeding the flow, the *post-menstrual period;* the week preceding it, the *pre-menstrual period,*

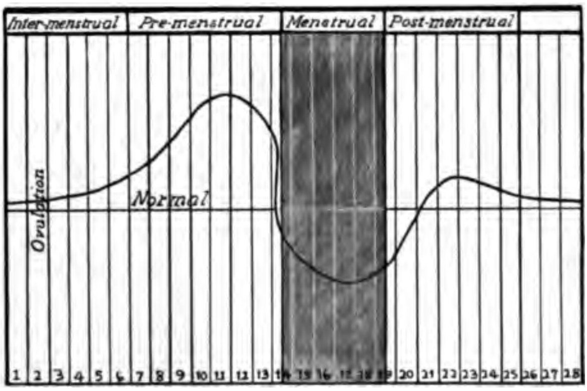

FIG. 21.—Menstrual curve. (After Menge and Opitz.)

and the intervening days, the *inter-menstrual period*. This last period is approximately ten days in duration.

Menstrual Changes in the Uterus.—During the intermenstrual period the uterine mucosa is in the resting stage, as described in the preceding chapter. Under the influence of the secretion of the developing corpus luteum in the ovary, which begins at the end of this period, the endometrium becomes thickened and hyperemic, the glands lose their simple tubular character and become corkscrew in shape and markedly dilated, as shown in Fig. 23. If now the ovum, which was set free from the ovary several days previously, is not fertilized by its union with a spermatozoön, the corpus luteum ceases to grow and commences to degenerate. This is attended by the rupture of certain superficial capillaries near the surface of the uterine mucosa and the menstrual flow begins. During the flow very little uterine tissue is actually lost, but the hyperemia is relieved and the mucosa shrinks. Gradually the loss of blood ceases, after having been most noticeable during the second day. During the entire period, the average healthy woman loses

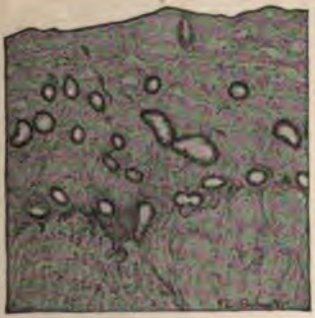

Fig. 22.—Normal endometrium—resting stage. (Williams.)

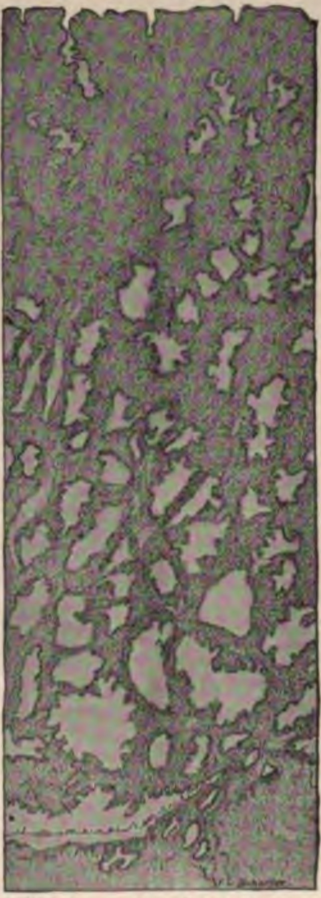

Fig. 23.—Normal endometrium—premenstrual swelling. Same scale as Fig. 22. (Williams.)

much less blood than is generally believed, the most recent estimate placing it at thirty to sixty cubic centimeters (one to two ounces), the remainder of the discharge being made up of cervical and uterine secretions which are greatly increased during this period. The post-menstrual period marks the final regression of the uterine mucosa to the resting stage; it repairs its tissue losses and becomes considerably thinner, while the glands again resume their simple tubular shape. The temperature, pulse and blood pressure fall during the flow to slightly below the average but during the post-menstrual period gradually return to normal.

Ovulation.—The rupture of a graafian follicle, with the extrusion of the contained ovum into the pelvic cavity constitutes *ovulation.* The released ovum is a small round cell, barely visible to the unaided eye, being only $^1/_5$ millimeter ($^1/_{125}$ inch) in diameter and weighing .000004 gram ($^1/_{160,000}$ grain). It is at once caught in the current set up in the peritoneal fluid surrounding the ovary by the cilia on the fimbriated extremity of the tube and is thus drawn into the open end of that organ. When one tube has been occluded by disease or removed by operation, the ovum sometimes crosses the pelvic cavity and passes down the opposite tube. This phenomenon is called *external migration of the ovum.*

Theory of Menstruation.—The present theory of the dependence of menstruation and ovulation upon the internal secretion from the corpus luteum accords well with most of the observed facts. The following sequence of events is based upon our present knowledge. A graafian follicle matures and ruptures, the ovum being extruded and carried to the tube where fertilization may take place. At the site of the rupture a corpus luteum is formed and elaborates an internal secretion, which gains access into, and circulates through, the blood stream, and serves to stimulate the uterine endometrium to rapid development. Within a few days this tissue becomes thickened and hyperemic (premenstrual swelling) in anticipation of the arrival of the ovum, which is estimated to reach the uterine cavity five to seven days after its escape from the follicle. If fertilization has occurred, the ovum finds an environment suitable to its further development. It burrows into the mucosa and grows rapidly, manufacturing a secretion which passes to the ovary by way of the blood stream and causes further development of the corpus luteum. This in turn stimulates the mucosa to further growth and thus prevents menstruation. If, on the other hand, the ovum is not fertilized, it soon dies, and as the corpus luteum fails to receive its stimulating secretion from the growing egg, it begins to degenerate. The uterine mucosa now lacks the stimulus to continued growth, and menstruation ensues.

Ovulation is supposed to occur ten to fourteen days before menstruation and, consequently, the resulting corpus luteum becomes well developed during the premenstrual period. It is responsible for the changes in the uterus as well as for the various alterations occurring in other parts of the body, which are identical with those observed in early pregnancy. In fact, it may be said metaphorically, that the earliest signs of pregnancy are observed before each menstrual period. If pregnancy intervenes, the corpus not only does not degenerate, but actually increases in size during the first three or four months of gestation and usually persists to its end (the corpus luteum of pregnancy). During this time its presence seems indispensable to the continued growth of the ovum, but during the latter half of pregnancy it is not essential, as it may be removed without causing interruption of the pregnancy. Normally, it persists as a functioning gland during the puerperal period. While it retains its secretory activity, other primordial follicles are prevented from developing to maturity, so that both menstruation and a second pregnancy are impossible.

Fertilization.—The process whereby the male sex cell, the spermatozoön, enters the female cell, the ovum, and activates it to development, is called *fertilization*.

During coitus the male semen is deposited in the upper portion of the vagina. Posteriorly to the cervix the vagina forms a shallow pocket, the receptaculum seminis, in which some of the fluid is retained. Normally the external os of the cervix dips into this pocket so that the passage of the spermatozoa into the uterine cavity is thereby facilitated.

The male sex cells, the spermatozoa, are contained in the seminal fluid in enormous numbers; one observer has estimated that about 300,000,000 of these tiny cells are deposited in the vagina at each coitus. Each spermatozoön has a flattened, triangular head containing a nucleus, a short connecting portion and a long filiform tail, which vibrates rapidly under proper environmental conditions and produces forward motion at the rate of one centimeter ($^2/_5$ of an inch) in three minutes.

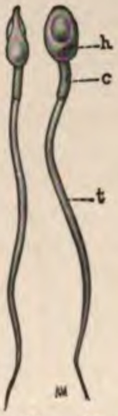

Fig. 24. — Human spermatozoa. (Williams.)

When set free in the vagina many of the actively moving spermatozoa enter the external os of the cervix and pass up the cervical canal to the uterine cavity. Here they make their way toward the orifices of the tubes against the downward current maintained by the cilia of the uterine mucosa and finally reach the outer third of the tubes, where they lie in wait for the ovum. Many of them undoubtedly attain their goal and find there such favorable conditions that they may live unimpaired for several days. According to our best knowledge the union of the two sex cells normally takes place only in the tubes.

Maturation.—Both animal and plant cells are composed of undifferentiated protoplasm and a nucleus. This latter structure contains among other things a number of very minute denser bodies called *chromosomes.* Each animal species has a characteristic number of chromosomes and the nucleus of every cell in the body of a member of that species has exactly that number. For the human race the number is twenty-four and it remains constant throughout the generations. Both the ovum and spermatozoön have the full or characteristic number of chromosomes when they are first formed, but before they can unite to form the original fetal cell each of them must suffer a reduction of its chromosomes to one half the usual number; otherwise when they join to become the nucleus of a single cell their number would be double that contained in the parents' cells. The process by which this reduction takes place in the ovum is called *maturation.* Its essential feature consists of the extrusion from the original ovum of small particles called *polar bodies,* which contain one half of the original number of chromosomes, while the other half remain in the mature egg cell. Accordingly, as a similar reduction has occurred during the formation of the spermatozoön, it likewise will contain only one-half of the usual number of chromosomes; so that when the male and female germ cells unite at the time of fertilization, the number of chromosomes in the new cell will be restored to that characteristic of the species. The polar bodies have no independent existence and perish soon after they are extruded. The mechanism of maturation is quite complicated and for a further discussion the reader is referred to the standard works on embryology.

The importance of the chromosomes is emphasized by the fact that they are concerned with the transmission of heredity and possibly also with the determination of the sex of the offspring. The twelve chromosomes of the ovum and of the spermatozoön carry the inheritable characteristics of the mother and father and the union of the two to form the first fetal cell with twenty-four chromosomes brings together the selected traits from the two parents.

Maturation begins just before the ovum is extruded from the ovary and is completed by the time it reaches the tube. The spermatozoa on the other hand are fully matured by a similar process before they leave the testicles and probably none but mature cells are ejaculated in the semen. The mature ovum in the tube attracts the spermatozoa and finally one of the latter penetrates into the cell substance of the former, after which the tail portion rapidly disappears and the nuclear portion of the head fuses with the nucleus of the ovum, bringing the chromosomes up to twenty-four in number. After one spermatozoön has gained access to the ovum the membrane surrounding it becomes impervious to the entrance of others and the process of fertilization is complete.

Heredity.—The theory of heredity based upon the transmission of characteristics by the chromosomes of the two sex cells—the ovum and the spermatozoön—is most attractive as furnishing a more or less mechanical basis for inheritance. The only cell actually coming to the fetus fully formed is the original ovum from the mother, and, aside from the impetus given by the spermatozoön, the further development of this cell depends upon soluble substances furnished by the maternal blood rather than upon the acquisition of formed elements. In spite of the old time belief in "blue blood" and its effect upon the individual, it is extremely difficult to imagine that brown eyes or red hair are bestowed upon an unborn child because the mother had those characteristics and nourished the child in its period of intra-uterine life. Frequent instances of blood transfusion from a stranger into a newborn child fail to afford any evidence in support of such a transmission. Moreover, the child frequently inherits physical traits from its father, when it is perfectly apparent that his blood never has had an opportunity to come in contact with that of his offspring.

With these facts in mind, one cannot escape the conclusion that the mental and physical characteristics of the child are determined at the moment of conception, when the chromosomes of the two sex cells meet and unite in the nucleus of the fertilized egg. This is well substantiated by observations upon single ovum twins, for here at a very early stage the fetal cells divide into two equal parts and each half goes on to full development. Such children are always of the same sex and are physically so alike that the term "identical twins" is frequently employed to express their mutual likeness.

The laity are usually ignorant of these fundamental facts and one finds them still believing in the exploded theory of "maternal impressions." According to this, the presence of birthmarks or other developmental abnormalities in the newborn are said to be due to some accidental occurrence experienced or seen by the mother during the course of pregnancy. For example, a six months' pregnant woman witnesses a fire near her home and later her child is born with a red birthmark or nevus. She firmly believes that the sight of the fire was responsible for the abnormality, whereas the basis for it must have been present in the very earliest stages of fetal development, and months before the supposed impression was made. As there is absolutely no scientific evidence to support the theory of maternal impressions, the nurse will perform a public service and save a great deal of anxiety by combating these ideas among her patients.

Eugenics and Euthenics.—Recently the study of heredity has been undertaken by several scientific institutions, and very interesting results have been obtained. Among other things, the value of physically and mentally sound parents has been proven by the intensive study of several generations from the same family. From such studies the science of *eugenics* has been developed, which means an endeavor to secure better children by the union of carefully selected parents. The opponents of this doctrine have developed *euthenics,* the science of improving the race by securing the best possible environment after birth. To the unbiased observer it must be apparent that both factors are worthy of consideration and that both inheritance and post-natal environmental influences may have a pronounced effect upon each individual.

CHAPTER III

DEVELOPMENT OF THE OVUM AND PHYSIOLOGY OF THE FETUS AND NEWBORN

General Development of the Ovum.—The mature ovum, as already described, is a single cell showing no tendency to develop until it has been fertilized by a spermatozoön in the fallopian tube. Once this has occurred, development proceeds rapidly; the single cell divides into two cells, the two into four, and so on, until a solid mass is formed, the *morula* or *mulberry mass.* During these early stages there is practically no increase in the actual size of the growing egg, the morula mass being of approximately the same weight as the fertilized ovum, on account of the smaller size of the individual cells following each division. This can be explained by the fact that we possess no evidence that the ovum obtains nourishment until after it has become imbedded in the uterine mucosa and, consequently, it cannot add to its substance until that has been effected.

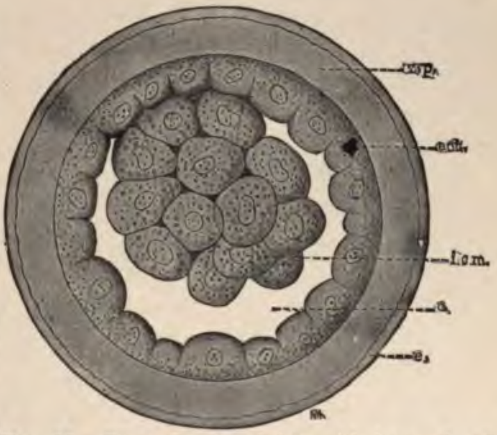

FIG. 25.—Blastodermic vesicle with internal cell mass. (Williams after v. Beneden.) (*c*, cavity of vesicle; *ect*, ectoderm; *i.c.m.*, internal cell mass; *z.p.* and *e.*, undifferentiated albuminous material.)

The next stage shows that the interior of the mulberry mass has degenerated, which results in the formation of a shell of growing cells surrounding a small fluid-filled cavity, the whole being called the *blastodermic vesicle* (Fig. 25). At one point upon the inner surface of the vesicle an accumulation of cells soon becomes visible—the *internal cell mass.* It is in this location that the fetus will appear and eventually, with its appendages, gradually fill the cavity of the vesicle. Before the outlines of the fetus are developed, the cells of this mass become differentiated into the three embryological types of tissue, *ectoderm*, *entoderm* and *mesoderm*, from one or more of which each of the organs of the body are formed.

Implantation of the Ovum.—It is generally calculated that the ovum requires about a week for its passage from the outer end of the tube where it was fertilized to the portion of the uterine wall upon which it becomes implanted. During this time it has not progressed beyond the morula stage and is still very tiny, not exceeding 0.2 millimeter ($^1/_{125}$ inch) in diameter. Once in the uterine cavity, it adheres to the decidua, usually near the middle of the anterior or posterior wall, and by its ferment action destroys the surface cells of the mucosa immediately beneath it and gradually burrows deeper into the depths of the decidua. The break in the mucosa is promptly repaired, so that the ovum soon comes to lie outside the uterine cavity, and is completely surrounded by the maternal tissues. Small blood vessels in the decidua are soon opened up by the same ferment action, and the ovum, still in the blastodermic vesicle stage, becomes bathed by and is in direct contact with the blood of the mother from which it receives its nutriment.

The Chorion.—As the egg grows, the outermost (ectodermal) cells adjacent to the maternal tissues become specialized in order to fulfill their double function of supplying food to the fetus and of removing waste materials from it. These cells, which possess markedly invasive properties, grow rapidly and constitute the *chorion* or outermost membrane of the egg. In the early ovum they are designated the *trophoblast*, which throughout pregnancy consists of fetal elements which remain in direct contact with the tissues of the mother. This chorion is pushed out by the tissue (mesoderm) beneath it and soon forms large numbers of long finger-like buds called *villi*, which project from its exterior (Fig. 26). Eventually the villi become extremely complicated arborescent structures. By the formation of such numbers of villi the absorbing surface of the chorion is increased many fold, just as a tree by branching is enabled to bear enough leaves to supply it with the necessary amount of carbon dioxid from the air.

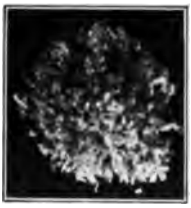

FIG. 26. — Exterior of early human ovum. Magnified four times. (Carnegie Embryological Collection No. 1878.)

When the villi first bud from the basal chorionic membrane they are covered on their exterior by two layers of cells, an inner designated as *Langhans' layer* and an outer designated as *syncytium*, whose structure is too complicated to be considered here. The core of each villus is made up of connective tissue, which is derived from the original mesoderm of the egg. Within a few days the rudiments of fetal blood vessels appear in the connective tissue of the villi and by the end of the first month they become coupled up with the circulatory system of the embryo through the umbilical cord, thus affording a direct passage from the interior of the embryo to the periphery of the chorion, but at no time during pregnancy do they communicate with the maternal blood. When, about the middle of pregnancy, the fetal need for food has been greatly increased, the inner or Langhans' layer of cells disappears, thus removing one of the barriers between the fetal and maternal bloods and promoting a freer interchange between them. From this time onwards, as a result of extensive branching, the villi become more arborescent in structure and the vessels within them develop a larger caliber.

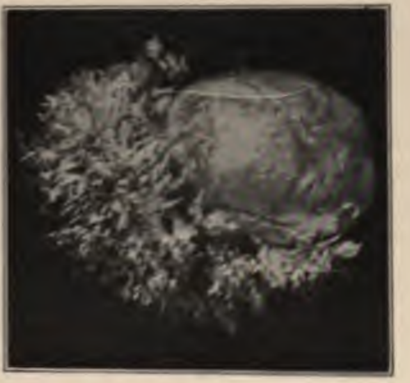

FIG. 27.—Exterior of older ovum to show chorion læve and frondosum. Magnified four times. (Carnegie Embryological Collection No. 1936.)

In early pregnancy, the entire outer surface of the ovum is covered with chorionic villi as in Fig. 26. As growth proceeds, however, the portion farthest removed from the area of implantation retrogresses and the villi covering it degenerate from lack of sufficient nourishment. Owing to the lack of villi this portion of the chorionic membrane is known as the *chorion laeve* or *bald chorion*, which functions only as a protective membrane. Meanwhile the rest of the chorion, which is in contact with the wall of the uterus, grows very rapidly and forms the *chorion frondosum* or *shaggy chorion*. Its villi penetrate deeply into the decidua and eventually form the fetal portion of the placenta.

Development and Structure of the Amnion.—The amnion first appears as a narrow slit in the internal cell mass and rapidly widens into a small sac, the *amniotic vesicle*. Its lining cells become differentiated early in the third week; those of the upper half forming the *amnion*, while the lower portion develops into the *embryonic area*—the first evidence of the embryo. For the first two weeks after fertilization the egg has been engaged in the process of implantation and in developing a mechanism which will provide for its nourishment. Only after these preliminaries have been completed does the fetus appear, and, as has already been indicated, its first sign consists of a cellular thickening on one side of the amniotic vesicle. As it takes shape it protrudes more and more into the amniotic cavity until finally its only connection with its walls is by means of the umbilical cord.

The early amnion is composed of a single layer of epithelial cells supported upon a thin connective tissue layer, which eventually fuses with the inner connective tissue layer of the chorion. Its structure remains the same throughout pregnancy, so that from its earliest stages the amnion forms a smooth, shiny, transparent membrane inclosing the amniotic fluid in which the fetus floats. The membrane is quite resistant, as long as it is intact, but it can easily be torn.

The amniotic fluid appears as soon as the amniotic vesicle begins to develop, and increases in amount as the latter increases in size. Normally it is a clear watery fluid, and at term averages about six hundred cubic centimeters (twenty ounces) in amount, but may vary from a few cubic centimeters to several liters.

The Decidua.—The *decidua* is the lining membrane of the uterus—the endometrium—which has been modified for the reception, implantation and nutrition of the fertilized ovum. The changes in the uterine mucosa incident to menstruation have already been described, and it has been stated that its stage of premenstrual swelling really represents the first change incident to pregnancy. According to this conception, preparation is made each month for the reception of a fertilized ovum. and, if this occurs, the mucosa continues to develop, instead of degenerating and being cast off at menstruation. In the early days of gestation the decidua increases considerably in thickness and becomes thrown into folds; the uterine glands are dilated and can be seen as small openings just visible to the naked eye. The histological changes involve the entire mucosa of the body down to the internal os and are similar to those observed in the premenstrual stage but are more pronounced. In the first three months of pregnancy the uterine decidua grows progressively thicker, but later it becomes thinned out by reason of the greater distention of the uterus. At the time of labor the greater part of the decidua is cast off with the placenta and fetal membranes, while the bulk of the portion remaining undergoes degeneration, and becomes detached and is thrown off in the lochia during the first few days after delivery. Small tags of decidua containing both glands and stroma deeply situated between the muscle bundles remain *in situ* and furnish the basis from which a new mucosa is regenerated.

Depending upon its position with reference to the growing ovum the decidua receives distinguishing names. That portion which lines the greater portion of the uterine cavity is designated the *decidua vera;* the area just beneath the growing ovum the *decidua basalis* (decidua serotina), and the section above the ovum, and separating it from the cavity of the uterus, the *decidua capsularis* (decidua reflexa). The decidua basalis is the most important, because it bears the greater part of the burden of nourishing the ovum and eventually forms the maternal portion of the placenta. As the developing ovum increases in size it pushes before it the decidua capsularis, which eventually fills the uterine cavity and approaches the decidua vera on the opposite wall and fuses with it during the fourth month of pregnancy, when the uterine cavity is completely obliterated.

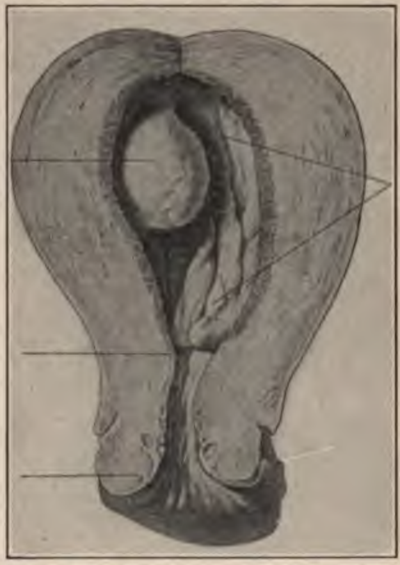

FIG. 28. — Uterus containing four-weeks ovum, showing decidua vera and decidua capsularis. (Bumm.)

The Placenta.—The *placenta* or *after-birth* is the organ formed of maternal and fetal tissues whereby the child is attached to the mother and through which it receives its nourishment. When first imbedded in the decidua, the ovum is able to obtain sufficient nourishment by absorption from the blood and lymph which surround it, but later, as its demands increase, the placenta is developed to supply the greater need. The placenta is formed by the union of the chorion frondosum with the decidua basalis and constitutes a spongy organ whose interstices are filled with blood from the mother and whose septa are made up of chorionic villi. The latter are very numerous and branching and are completely surrounded by maternal blood which enters the placental space from branches of the uterine arteries and leaves through the corresponding veins. The majority of the villi end free in the intervillous spaces, but a few continue down and become attached to the decidua. These latter are known as *fastening villi* and apparently serve to make the attachment of the placenta to the uterine wall more secure than it would otherwise be.

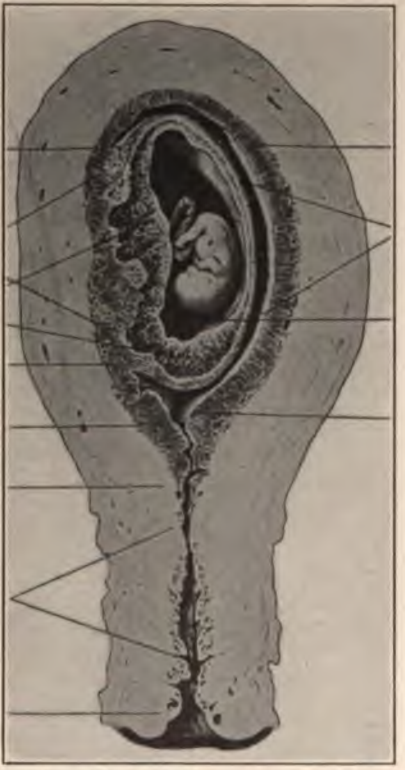

FIG. 29.—Two-months pregnant uterus—sagittal section. (Bumm.)

The placenta is a temporary organ whose function is the transmission of materials between mother and fetus without the necessity of direct connection between the two circulations. For the first three or four months it is larger than the fetus, but later this relationship is reversed so that at term the placenta weighs only about one-sixth as much as the child. While still *in utero* it occupies perhaps one-quarter of the internal surface of that organ, while the remainder is covered by the fetal membranes—the chorion and amnion—which are in contact with the decidua vera. The placenta averages 1.0 to 2.0 centimeters ($^2/_5$ to $^4/_5$ inch) in thickness, but after its expulsion as the after-birth, it is a flattened, round or oval, cakelike mass 15.0 to 18.0 centimeters (6 to 7 inches) in diameter and 2.0 to 3.0 centimeters ($^4/_5$ to $1^1/_5$ inches) thick. Extending from its periphery are the membranes which have been detached from the uterine wall and expelled by the same mechanism, and which consist of the amnion, chorion and portions of the decidua.

The freshly expelled placenta presents both a fetal and a maternal

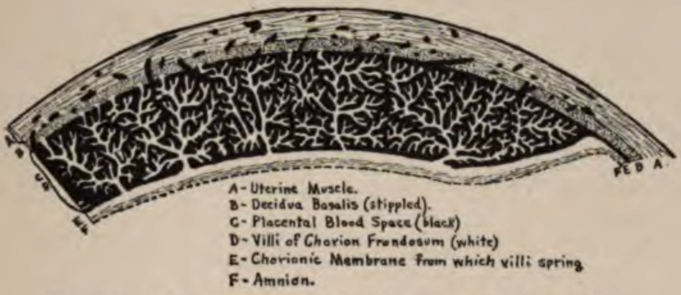
A
B
C
D
E
F
F E D A
A - Uterine Muscle.
B - Decidua Basalis (stippled).
C - Placental Blood Space (black)
D - Villi of Chorion Frondosum (white)
E - Chorionic Membrane from which villi spring
F - Amnion.

FIG. 30.—Schematic section showing structure of placenta.

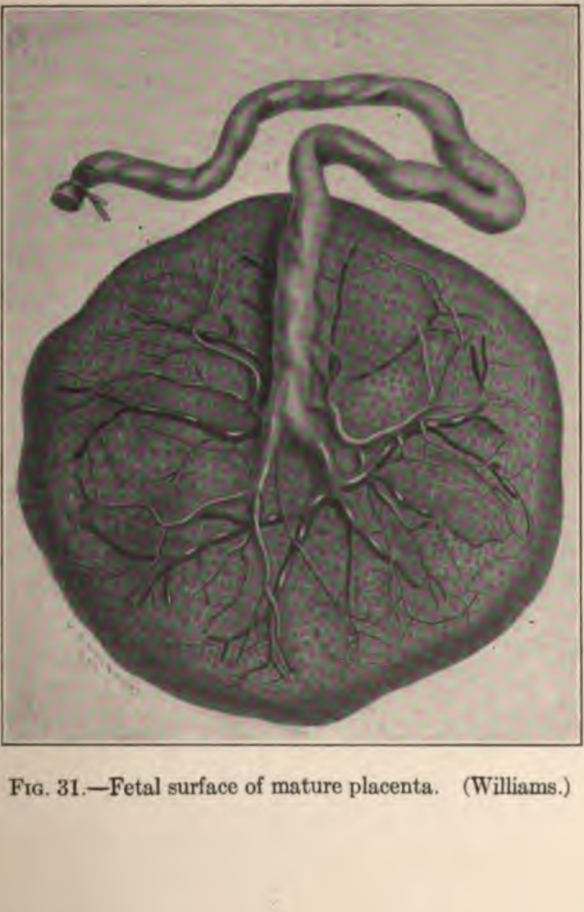

FIG. 31.—Fetal surface of mature placenta. (Williams.)

surface. The former is covered by the smooth, glistening amnion and is marked by the attachment of the umbilical cord. The umbilical vessels branch upon reaching the placenta and the dilated veins are readily visible just beneath the amnion. The maternal surface is ragged in appearance and is divided by intersecting depressions into numerous irregular shaped masses, the *placental cotyledons.*

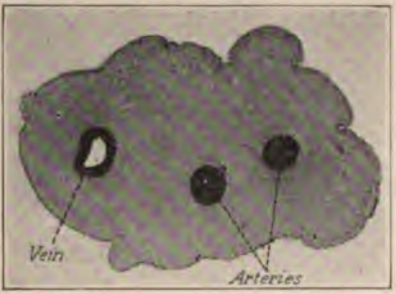

FIG. 32.—Cross-section of umbilical cord. (Micro-photograph.)

The Umbilical Cord.—The umbilical cord extends from the fetus to the placenta and carries the umbilical vessels—two arteries and a vein. The former carry venous blood from the fetus to the placenta and the latter the oxygenated arterial blood from the placenta to the fetus, thus reversing the conditions ordinarily obtaining. The cord is dull white in color, with the vessels shimmering through its translucent sheath. It averages 50.0 centimeters (20 inches) in length and from 1.0 to 2.5 centimeters ($^2/_5$ to 1 inch) in diameter. Very short cords, 10.0 to 15.0 centimeters (4 to 6 inches) in length, are rarely seen and those over 100.0 centimeters (40 inches) are likewise infrequent. The cord is usually twisted upon itself from right to left (contraclock-wise) and occasionally as many as twenty or thirty complete turns can be counted. The irregular appearance so often noted is due to the presence of loops of engorged blood vessels.

The substance of the cord is made up of a mucoid tissue, whartonian jelly, and the surface is covered by a single layer of epithelial cells which is continuous with the amnion. At the point of union with the abdomen of the child, this epithelium gives way abruptly to the many layered skin of the abdomen. In the early stages of development, the precursor of the umbilical cord is called the *abdominal pedicle.*

The Umbilical Vesicle.—The umbilical vesicle is the remnant of the yolk sac of the embryo. In the early stages of development it plays a very important part and makes up a large part of the ovum. It soon ceases to be necessary for the growth of the egg and undergoes regressive changes, but nevertheless persists throughout pregnancy. In the full-term placenta it can usually be found lying between the chorion and the amnion. It appears as a small, yellowish, oval structure about 3.0 to 5.0 millimeters ($^1/_8$ to $^1/_5$ inch) in diameter.

Growth of the Fetus.—The average duration of pregnancy is two hundred and eighty days or ten lunar months from the first day of the last menstrual period. Strictly speaking, the developing egg is known as an *ovum* for the first two weeks of its growth; as an *embryo* during the next three weeks while its organs are being formed, and as a *fetus* from the end of the last period until the time of birth. Not uncommonly the two latter terms are loosely employed as synonyms.

The first two weeks are occupied with the formation of the chorion, and only during the third does the amniotic vesicle appear, the floor of which is to be the embryo and the roof the amnion. Late in the third week, the head appears as an enlargement of the fore-end of the embryo and the heart makes its appearance. During the fourth week the limb buds develop, but the embryo has little or no resemblance to the human form.

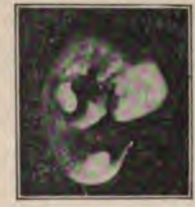

Fig. 33.—Early human ovum — five weeks. Length eight millimeters. Three times natural size. (Carnegie Embryological Collection No. 3441.)

During the second month the head increases in size relatively to the body and the face, eyes and ears appear. Late in the month the external genitalia are developed and experienced observers can differentiate the sexes. The limb buds show the beginning separation of fingers and toes at about this stage. The third month is marked by the first appearance of real bones, formed by the deposition of lime salts in the existing cartilaginous structures. By the fourth month the sex can be easily told and the fetus is growing much more rapidly. The next month is characterized by the appearance of fine, downlike hairs over the entire body—the *lanugo*. From the sixth month on the fetus if born will move and breathe, but has almost no chance of being raised until after the end of the seventh month, while it differs from the mature infant practically only in size.

The length of the fetus is a much better criterion of its age than is its weight. A rapid approximation of the former at the end of any month of pregnancy can be obtained as follows: during the first half of pregnancy the square of the month gives the length in centimeters and in the second half the month multiplied by five does the same thing. For example, at the end of the fourth month, the length of the fetus is 16 centimeters (4 × 4), and at the end of the seventh month it is 35 centimeters (7 × 5). For still more accurate estimations the *sitting height* or *crown-rump* measurement is now being employed, but such measurements are too technical for general use.

It is interesting to note that the relative growth of the ovum is greatest during the first months, whereas the actual gain is most marked during the weeks just before birth. In the earliest stages of development all cells probably grow at the same rate, so that each division doubles the total number, whereas later, after differentiation into organs has occurred, the specialized cells grow at different rates and a much longer interval is required for such a relative gain. It is stated that the greatest increase in length occurs during the sixth month, when it amounts to 12.7 centimeters ($5^1/_2$ inches).

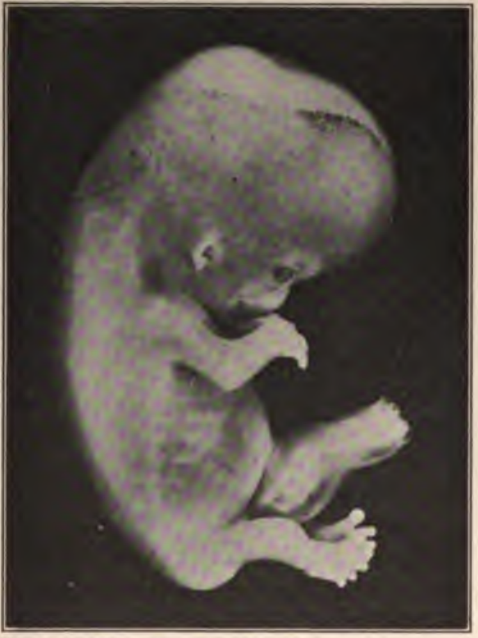

FIG. 34.—Human embryo—eight and one-half weeks. Length twenty-eight millimeters. Three times natural size. (Carnegie Embryological Collection No. 1945.)

At full-term the average newborn child is 50.0 centimeters (20 inches) long and weighs about 3250 grams ($7^1/_4$ pounds). The skin is smooth and the lanugo hairs have disappeared except perhaps over the shoulders. The head is covered with hair about an inch long and the nails of the fingers and toes are well developed. The surface of the body is covered by a thick, white, greasy material, the *vernix caseosa*, which is composed of the secretion of the sebaceous glands of the skin mixed with epithelial cells and lanugo hairs, and accumulates especially in the folds of the groin and axillae. The external genitalia are fully formed and the head bones are well ossified.

Weight of the Newborn.—As has already been noted, the average weight of the newborn child is 3250 grams ($7^1/_4$ pounds); boys are generally about one hundred grams (three ounces) heavier than girls. Colored children are usually somewhat smaller than those of white parents; poorer food and less hygienic living conditions being responsible for the difference. The babies of women in comfortable circumstances, on the other hand, have a greater average weight than those of free patients in the hospital wards. Most children weigh either more or less than the average given, but a full-term infant rarely weighs less than 2500 grams ($5^1/_2$ pounds) or more than 5000 grams (11 pounds). Uneducated midwives, as well as inaccurate doctors, frequently estimate the weight of the baby by "lifting" it in the hand, with the result that great exaggeration occurs and many of their patients will tell of having had babies weighing from fifteen to twenty pounds. One should be very careful in accepting such statements, as reliable European statistics show that in a total of 78,500 deliveries only 27 babies weighed over 5000 grams (11 pounds). When children weigh 4500 grams (10 pounds) or more at birth, it is frequently due to the fact that pregnancy has lasted some weeks beyond the normal forty.

Generally speaking, the children of succeeding pregnancies tend to be progressively larger up to the fifth, after which they tend to weigh less than the average. Women in the neighborhood of thirty years of age are apt to have larger babies than those who begin child-bearing at an earlier period. Ordinarily, a child weighing 4500 grams (10 pounds) or less does not complicate labor, because the size of the head does not increase in proportion to the weight, but beyond this limit excessive size of the baby may give rise to serious complications.

Head of the Child.—Inasmuch as labor is really a process of adaptation of the head of the child to the unyielding bony pelvis of the mother, it is essential that we know something of the structure of the fetal head in order to understand the mechanism of labor.

The cranial portion of the head is larger proportionately than in the adult and is most interesting obstetrically. It is made up of the following bones: two frontal, two parietal, two temporal, the occipital and portions of the sphenoid bone. The last named is at the base of the skull and is not palpable or visible externally. The positions of the several bones are indicated in Fig. 35. They are not firmly connected as in the adult, but are separated by narrow membranous spaces called *sutures*. In the living child the following sutures can be palpated: *frontal*—between the two frontal bones; *sagittal*—between the two parietal bones; *coronal*—between the frontal and parietal bones, and, *lambdoidal*—between the parietal and occipital bones. The *temporal*

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suture separating the parietal and temporal bones cannot be palpated because of the heavy covering of soft tissues.

Whenever several sutures meet, an irregularly shaped opening results, which is covered with a heavy membrane and is known as a *fontanelle.* Only two of them are of obstetrical importance; the *large fontanelle* (anterior fontanelle or bregma), a diamond-shaped area between the frontal and parietal bones where the coronal, frontal and sagittal sutures meet, and, the *small fontanelle* (posterior fontanelle or lambda), a triangular space between the parietal bones and the occipital bone at the junction of the sagittal and lambdoidal sutures. Perhaps once or twice in a hundred cases one finds an *accessory* or *sagittal fontanelle,* occurring somewhere in the course of the sagittal suture. It is due to faulty development of the parietal bones and is very inconstant in shape and position.

After the external os of the cervix has become dilated during labor, the sutures and fontanelles can usually be felt on vaginal examination, and give the physician important information concerning the position of the fetus, although marked edema of the scalp may interfere with their exact differentiation.

The membranous union between the various bones permits considerable motion, and, as a result of the pressure exerted during labor, the bones frequently overlap and diminish the dimensions of the head. When the pelvis is smaller than normal this compressibility is particularly important, as it may permit the occurrence of spontaneous delivery, which would have been impossible had the head not been reducible in size.

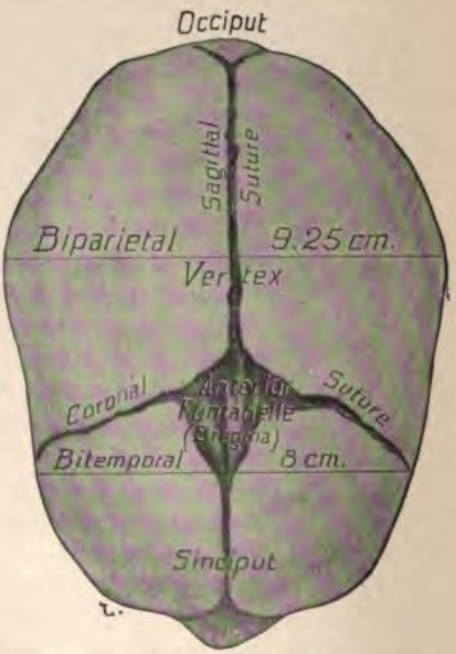


Fig. 35.—Head of new-born child—top view. (Williams after American Text-Book.)

Certain diameters and circumferences are usually noted when describing the head of the child: the *fronto-occipital diameter* extending from the root of the nose to the most prominent portion of the occiput; the *biparietal diameter* representing the greatest transverse diameter of the head and extending from one parietal boss to the opposite; the *bitemporal diameter,* the greatest distance between the two temporal sutures; the *mento-occipital diameter,* from the tip of the chin to the farthest point of the occipital bone, and, the *suboccipito-bregmatic diameter,* extending from the lowest middle point of the occipital bone to the center of the large fontanelle. Moreover, the greatest circumference of the cranium, the *fronto-occipital,* passes around the head over the root of the nose and the farthest point of the occiput, and the smallest circumference, the *suboccipito-bregmatic,* extends around the head over the lowermost portion of the occipital bone and the center of the large fontanelle.

The following table gives the average measurements of the various diameters and circumferences:

AVERAGE MEASUREMENTS OF FETAL HEAD

	Abbreviation	Centimeters	Inches
Diameters of the fetal head			
Fronto-occipital	F.O.	11.75	4½
Biparietal	Bip.	9.25	3⅔
Bitemporal	Bit.	9.00	3⅙
Mento-occipital	M.O.	13.50	5⅓
Suboccipitobregmatic	S.O.B.	9.50	3¾
Circumferences of the fetal head			
Fronto-occipital	Greatest	34.50	13½
Suboccipitobregmatic	Least	32.00	12½

Boys usually have slightly larger heads than girls, and white babies than colored. The children of primiparae frequently have smaller heads than those of multiparae. In many instances there is a close relationship between the size of the child's head and that of its parents—particularly the father. For example, if the latter wears a hat of unusual size, the baby's head tends to be exceptionally large and hard.

Statistics show that throughout the civilized world more boys are born than girls, the average incidence being 106 to 100, and it is generally stated that if the first child is born after the thirtieth year of life the ratio of males increases to 120 to 140 to every 100 females.

Recent investigations have shown that the factor which determines sex must be present in one of the two original cells, the ovum or the spermatozoön, because there can be little doubt but that the sex of the child is determined before any cell division occurs. Theories differ as to which cell carries the deciding factor, some claiming that it is the ovum and others that it is the spermatozoön. The best scientific work favors the latter view; and the accumulated evidence of researches upon the lower animals indicates a variation in the arrangement of the chromosomes of the spermatozoa and a constant arrangement of those of the ova. Consequently, two types of spermatozoa and only one type of ova are met with in each species, so that males or females invariably result according as the ovum is fertilized by the one or other type of spermatozoön, respectively. According to this idea, the ovum plays a purely passive rôle, and takes no active part in the determination of sex. This being the case, the determination of the sex of the child is not in our hands, and nothing that may be done after fertilization has occurred will affect it.

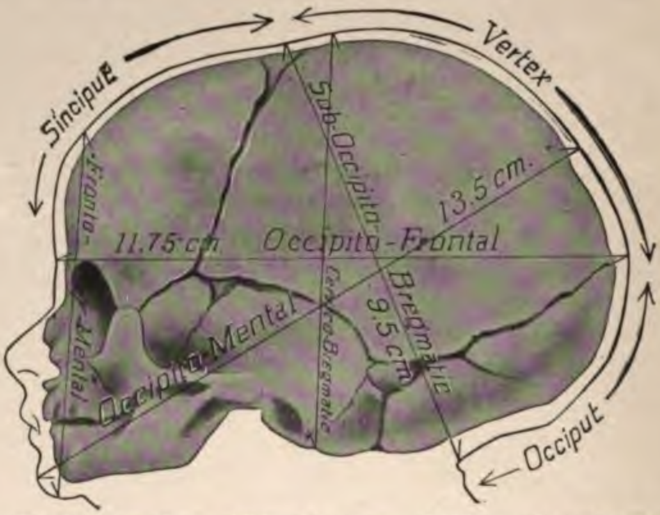


FIG. 36.—Head of new-born child—side view. (Williams after American Text-Book.)

The fact of the matter is that, contrary to the belief of many, there is no way of predetermining the sex of the child, nor even a method for discovering its sex before the time of birth. The single exception to this statement occurs in breech presentations where the sex can sometimes be learned by palpating the external genitalia in the course of a vaginal examination during labor.

The old idea that a rapid fetal heart signifies a girl and a slow heart a boy is not borne out by actual observation. Consequently, prognostications based upon such evidence are practically valueless, and as such the probability of error is fifty per cent.

The physiology of the fetus is so different from that of the child that it must be considered in some detail, so that the changes occurring at the time of birth may be better understood.

Nutrition of the Fetus.—For the week after fertilization the ovum divides many times to form the morula mass, but during this time there is no actual increase in size. The resulting cell mass contains the same amount of protoplasm as the original ovum, thus indicating that at this early stage there is no mechanism for furnishing nourishment to facilitate its growth. However, as soon as the ovum has become imbedded in the decidua, it erodes the surrounding cells and becomes bathed with the fluids derived from the maternal tissues. By utilizing these it gains some nutritive material and commences to increase in bulk. Shortly afterwards the maternal blood vessels are opened up and the circulating maternal blood comes in contact with the trophoblast covering the exterior of the ovum. At the end of the first month the chorionic villi have been formed, with the result that the surface has become markedly increased in order to meet the requirements of the fetus. The connection between the umbilical vessels and those in the villi is effected at this time and ideal conditions for growth are thus established. The ovum and early fetus consist almost entirely (ninety-four per cent) of water, the solid elements being added gradually during the later development.

Practically all the nourishing materials received by the growing fetus come through the villi from the surrounding maternal blood, although it is barely possible that small quantities of food may be obtained from swallowing the amniotic fluid.

Circulation.—The fetal circulatory apparatus differs considerably from that of the child. When it is remembered that the lungs do not function until after birth and that the respiratory exchange is carried on through the placenta, the need for special arrangements can be appreciated. The digestive tract is likewise not functioning and, consequently, all nutritive material must be brought to the fetus from the placenta, which may be regarded as serving the function of the stomach as well as of the lungs.

In order to trace the course of the blood through the fetus it is perhaps best to begin with the arterial blood leaving the placenta through the umbilical vein. This vessel extends the entire length of the cord and enters the body of the child at its umbilicus. After penetrating the abdominal wall it divides into two branches; the smaller joins the portal vein, and the larger, the ***ductus venosus,*** empties directly into the vena cava. The blood in the former passes through the liver and gains access to the vena cava by the hepatic vein. Thus, both purified arterial blood from the placenta and venous blood from the lower extremities and liver enter the right auricle through the inferior vena cava. Furthermore, the blood from the upper extremities and the head is returned to the heart through the superior vena cava, and in the right auricle becomes mixed with the blood from the lower part of the body. Part of the blood is now directed through the foramen ovale into the left auricle and hence into the left ventricle to be propelled through the aorta by the contractions of the heart, while the remainder passes directly into the right auricle and hence into the pulmonary arteries. The lungs, however, are not functioning and very little of this blood is sent to them, so that the great part of it is shunted through the *ductus arteriosus* into the aorta. From this point the flow takes the blood to the various parts of the body, the greater portion passing into the internal iliac arteries, whence it goes into the hypogastric arteries. These latter pass up the anterior abdominal wall, and, entering the umbilical cord, are continued to the placenta as the ***umbilical arteries.***

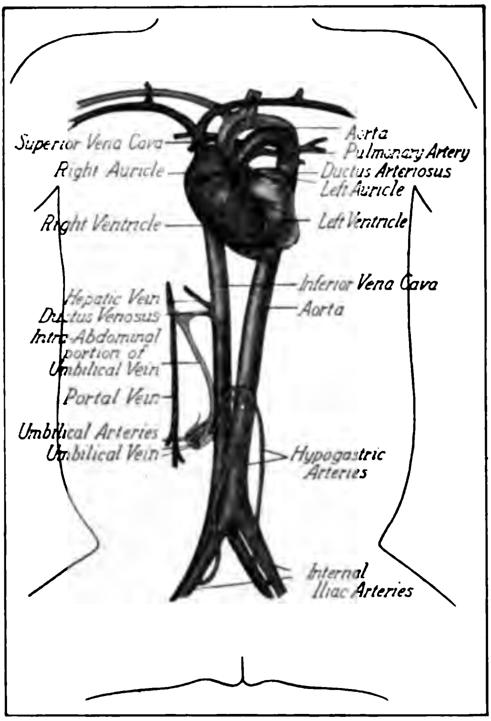


FIG. 37.—The fetal circulation. Diagrammatic.

The peculiarities of the fetal circulation are in great part due to the fact that the lungs do not function and that the blood is aerated, and is also supplied with nutritive material in the placenta. Consequently, the umbilical vein carries only arterial blood and the umbilical arteries contain only venous blood, while the aorta carries a mixture of venous and arterial blood. The changes which occur at birth in order to fit the circulation for extra-uterine life will be considered later when the physiology of the newborn is taken up.

Respiration and Digestion.—The lungs of the fetus do not function, and, therefore, do not contain air until the first respiratory movements are made, immediately after birth. For this reason the lungs of an unborn child will sink when placed in water, but after birth, even if the child has drawn only a few breaths, the contained air will cause them to float. The oxygen necessary for the fetus *in utero* is supplied through the placenta, which thus takes the place of the lungs. The fetus requires relatively little oxygen, but any interference with its limited needs quickly results in death from asphyxiation. In the last months of intra-uterine life the lungs are well developed and are capable of beginning their work of supplying oxygen as soon as birth gives the necessary stimulation to the respiratory center in the brain. A fetus born as early as the fifth month may gasp a few times immediately following its expulsion from the uterus. Its organs at this time are, however, not ready to take up the burden of an independent existence and it promptly succumbs.

The digestive system is developed early in fetal life and after the sixth or seventh month it is able, under favorable conditions, to break down the simpler foods into compounds which can be assimilated by the organism. The various digestive juices, such as saliva, gastric juice and bile, are present in small quantities after the fifth month of intra-uterine life. *In utero* this function is not utilized, as all the nutritive material is supplied from the mother's blood by way of the placenta, while the small quantity of amniotic fluid that may be swallowed is not sufficient to stimulate the organs to activity.

The Urinary Tract.—Development of the kidneys begins early and proceeds so rapidly that even in very premature infants urine is secreted at or shortly after birth. There are no grounds for believing the statement frequently made that the fetus voids urine into the amniotic fluid, but many newborn children pass urine as soon as they are out of the uterus. This, of course, indicates that the kidneys have been functioning during labor at least and are ready to assume their rôle of ridding the body of waste materials.

Placental Transmission.—It has already been emphasized that there is no direct connection between the blood of the mother and that contained in the vessels of the fetus. Consequently, whatever substances pass from one to the other must be in solution and must penetrate the various cell layers of the placental villus. The method by which this passage is effected apparently varies with different substances, some obey the laws of simple osmosis, while others are actively selected by the tissues of the villi for the use of the fetus. In all probability gases, sugar, the end products of protein metabolism and certain other substances, are transferred from one side to the other of the villus wall by the first mechanism, so that the concentration of these substances in the maternal and fetal blood is always the same. On the other hand, the materials which are necessary for the growth of the fetus are maintained in higher concentration on the fetal side of the partition, thus indicating some selective action on the part of the ectodermal cells covering the villi. This latter provision assures the fetus a constant supply of building materials even though the maternal organism has to be nearly depleted in order to supply them. An interesting example of this pillaging of the resources of the mother by her unborn baby is found in certain cases of anemia. Here the maternal hemoglobin may be as low as 20 per cent, but the baby's blood at birth will have its full quota of 100 to 120 per cent. In general, it may be said that the fetus acts as a parasite and will obtain what it needs even though the mother's supply of the particular substance is reduced almost to a minimum. In most instances, however, there is a limit to which depletion of the maternal tissues can be affected, so that after it is reached the fetus suffers.

Gases when dissolved in the blood readily pass through the placenta. Oxygen is constantly going to the fetus and the carbon dioxid representing one of its waste products is similarly being passed to the mother, who eliminates it through her lungs. Ether, chloroform and nitrous oxid, when administered to the mother, soon gain access to the fetus, so that, sometimes, following an operative delivery, the infant remains partially anesthetized for a varying period.

Likewise, various toxins and antitoxins in the maternal blood find their way to the fetus. The fact that newborn babies are practically immune to the usual infectious diseases such as measles, scarlet fever and diphtheria can best be explained by the transmission of the immunity-conferring substances from the mother during the period of intra-uterine life. Whooping cough (pertussis) is an apparent exception to this rule, as it may be contracted even by the newborn, when it may prove to be a serious complication. Antityphoid inoculation during pregnancy will produce a positive Widal reaction in the serum of the newborn.

Bacteria do not ordinarily pass the intact placenta, but occasionally it may present lesions which diminish its value as a filter and permit micro-organisms to enter the fetal circulation. Thus, children have been born pockmarked after the mother had suffered from smallpox during gestation, and frequently, when the mother is suffering from typhoid fever at the time of delivery, the characteristic bacilli can be demonstrated in the child's blood.

On the other hand, tuberculosis is never transmitted from the mother to her child before birth. The high incidence of the disease among the children of tuberculous parents can be attributed to post-natal infection.

The transmission of syphilis from mother to child undoubtedly occurs, but whether the treponema pallidum infects the child during its intra-uterine life or was present in the ovum at the time of fertilization cannot be dogmatically stated. The unknown substance producing the Wassermann reaction may or may not be transmitted; frequently both mother and child present a positive reaction, and again one may be positive and the other negative. The discussion of syphilis will be taken up in a later chapter.

The Nature and the Function of the Amniotic Fluid.—The most important function of the amniotic fluid is mechanical; it maintains a constant temperature around the fetus and protects it from injury from without. It is probably swallowed in small quantities by the fetus, which thus gains at least a part of the water needed for its development. The solids in the fluid may be utilized but can furnish very little nutriment.

The source of the amniotic fluid is still in doubt; the most acceptable view is that it is derived from the maternal blood plasma by a process of secretion through the amniotic epithelium. Formerly it was considered to be fetal urine, but chemical analysis, as well as biological research, has rendered this view untenable.

CHAPTER IV

NORMAL PREGNANCY

The Duration of Pregnancy.—The popular idea that normal pregnancy lasts nine calendar months is approximately correct, but in medical circles its duration is generally set at ten lunar months of four weeks each, 273 and 280 days respectively. The actual duration of gestation, however, is subject to considerable variation, and one cannot predict the exact date of confinement, even when the time of conception is supposed to be accurately known. In a large series of patients, who were able to designate the exact day of the fruitful coitus, the onset of labor occurred, on an average, 270 days later, with 231 and 329 days as the two extremes. Among animal breeders the same uncertainty exists, and, even though they know the date of the coitus which inaugurated the pregnancy, they cannot accurately predict the date of delivery.

Occasionally, among women who lead a sedentary life, there is a tendency for delivery to be delayed two or three weeks beyond the expected date. Such patients should be closely watched, in order that the fetus may not grow to such a size as to interfere seriously with labor. If the pregnancy has gone beyond the expected date and the child is larger than usual, labor should be induced, in order to avoid the serious consequences which may attend the delivery of an excessively large baby.

Estimation of the Date of Confinement.—With the existing uncertainty concerning the exact duration of pregnancy, the estimation of the date of delivery is naturally inaccurate. The method generally employed for approximating this date is based upon the belief that pregnancy will continue for 280 days after the onset of the last menstrual period. Thus, one may count ahead 280 days or back 85 days, but the same result may be obtained much more easily by adding seven days to the date of the onset of the last menstrual period and then counting back three months. For example, if the last period began on December 10, adding seven days gives December 17, and counting back three months sets September 17 as the approximate day of delivery, or the *estimated date of confinement*. Only a small fraction of patients will be delivered on the exact day calculated, but fifty per cent will fall into labor within three or four days before or after the estimated date, and eighty per cent in the two weeks before and after. In the remaining twenty per cent delivery will occur earlier or later, with the chances favoring the latter date. When delivery occurs considerably after the expected date it can frequently be explained by the fact that fertilization occurred just before the first period missed, rather than immediately following the last flow.

Young married women who miss the first menstrual flow after marriage frequently give birth to full-term children two hundred and eighty days after the onset of the last period or from one to three weeks less than nine calendar months after marriage. Such cases are regarded by busy-bodies with some suspicion but ordinarily there is no reason to suspect any indiscretion.

In the case of women who become pregnant while suckling and in those who only menstruate irregularly and at long intervals, such calculations cannot be made, and the estimated date must be arrived at by some other procedure than the one mentioned above. Menstruation and ovulation are usually suppressed for from three to twelve months during the lactation period, and it may happen that the first ovum extruded from the ovary will be fertilized, when the return of the flow will be postponed until after the completion of the new pregnancy. There are on record some women who have raised large families of children without ever having menstruated; the pregnancies following so closely that the function was always held in abeyance.

In such patients the date of the first perception of fetal movements may be utilized for approximating the date of delivery. The method is, however, far from accurate, because of the purely subjective character of the phenomenon of quickening. It is usually stated that fetal movements become perceptible to the mother between the eighteenth and twentieth week of pregnancy and that delivery will occur twenty to twenty-one weeks later. On the other hand, slight quiverings may be felt as early as the twelfth or fourteenth week, if attention has been particularly directed to this phenomenon or if the patient has had previous experience; but if pregnancy is not suspected, quickening may pass unnoticed, and the patient's suspicions will not be aroused until the enlarging abdomen renders her condition apparent.

From an objective point of view, the physician must depend upon the size of the growing uterus to confirm the estimated date of confinement, which, of course, is based upon the statements of the patient. The fundus of the uterus rises gradually, and at the end of the various months of pregnancy occupies the levels indicated in Fig. 38. This shows that at forty weeks—ten lunar months—the fundus is somewhat lower than at thirty-six weeks—nine months. This phenomenon is termed *"lightening"* by the laity and its explanation is quite simple: during the early part of the tenth month, particularly in primiparous patients, the head of the fetus, which has been in the abdominal cavity, sinks deep in the pelvis and the fundus promptly becomes lower. When it occurs, the patient experiences considerable relief from the marked abdominal distention and her waist line drops several inches. In multiparous individuals, the rise of the fundus does not follow the given outline very closely, particularly when their abdominal walls are lax and flabby. Moreover, the head may not descend into the pelvis until labor has actually begun.

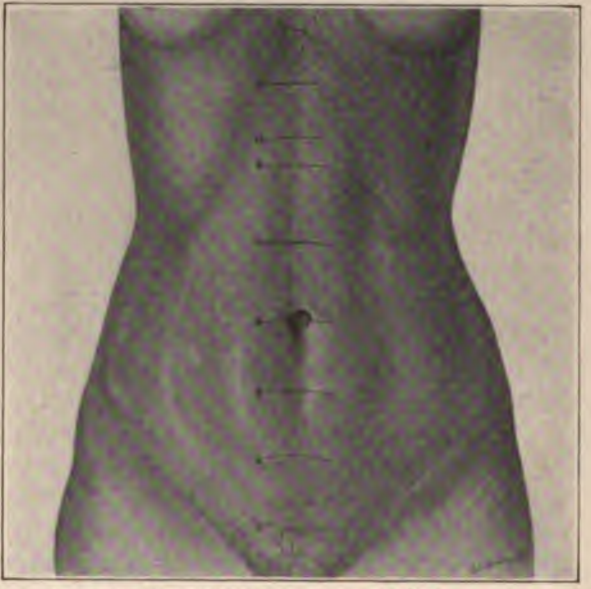


FIG. 38.—Approximate height of fundus at the end of the various months of pregnancy.

This method of examination is not accurate and errors of a full month are not uncommon, even among well-trained physicians. After some experience one develops the ability to estimate the size of the child *in utero* and combines this evidence with the height of the fundus in making prognostications. In such examinations it is essential that the bladder and lower bowel be empty, because their distention may push the uterus an inch or two higher up in the abdominal cavity.

Changes in the Organism During Pregnancy.—To some extent pregnancy affects all the tissues and organs of the body, but the changes are most noticeable in the organs concerned in generation, especially the uterus and the breasts. Some of the observed changes are purely mechanical in origin, whereas others are due directly or indirectly to the growing ovum, the stimulus from which is carried in the blood stream by what are called *chemical messengers* or *hormones.*

The Uterus.—This organ undergoes the greatest alteration during gestation. In the non-pregnant condition it is 5.5 to 8.0 centimeters ($2^1/_5$ to $3^1/_5$ inches) long and weighs 40 grams ($1^1/_3$ ounces), whereas at the end of pregnancy it is 35.0 centimeters (14 inches) long and weighs 1000 grams ($2^1/_5$ pounds) when empty. It has been estimated that the capacity of its cavity is increased over five hundred times, from about 6.0 cubic centimeters ($1^1/_2$ drams) to 4000 cubic centimeters (over 4 quarts). The uterus is essentially a muscular organ and its great increase in weight and size is due primarily to a hypertrophy of the existing muscle, but in part also to the formation of new muscular fibers during the first three or four months of pregnancy. Its increased capacity is necessitated by the growth of the inclosed fetus and eventually leads to a gradual thinning of the muscular walls until at term they do not exceed 5.0 millimeters ($^1/_5$ inch) in thickness. As preg-

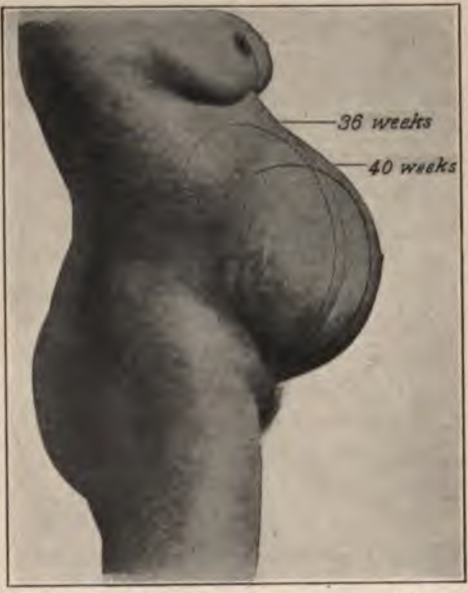


FIG. 39.—Composite drawing to show difference in profile of pregnant woma n before and after "lightening" has occurred. (Bumm.)

nancy advances, the walls likewise become much less firm, and, in the latter months, are so soft and yielding, that the parts of the fetus can be distinctly felt and the fetal movements readily seen through the abdominal wall.

The original pear-shape of the organ is retained for about two months, after which it becomes progressively more globular. Later it grows more rapidly in length and becomes ovoid in outline, to accommodate the fetus.

The cervix changes relatively little; it increases slightly in size and becomes markedly softened because of the augmented blood supply. The secretion of the cervical glands is more profuse and accounts in part for the increased vaginal secretion noted during pregnancy.

In the early months the anteflexion of the uterus is accentuated, but, after it has emerged from the pelvis, pressure against the anterior abdominal wall straightens out the angle, until at term the axis of the body and the cervix form an almost straight line. As the uterus rises into the abdomen, it frequently becomes somewhat twisted on itself, so that its left margin is directed more anteriorly than the right. This phenomenon is called *torsion of the uterus,* and is due to the presence of the rectum and sigmoid in the left lower portion of the pelvic cavity.

As the vessels of the uterus are required to furnish progressively larger quantities of blood to the rapidly growing organ, they meet this demand by undergoing a hypertrophy and dilatation without the formation of any new elements, so that at term the arteries are many times their original diameter and some of the veins are the size of a lead pencil.

With the increase in size of the uterus, the attached ligaments are subjected to considerable tension, and, as a result, the broad ligaments are stretched upward and draw the pelvic peritoneum with them, making this tissue unusually loose and mobile. Likewise, the muscular tissue of the round ligaments hypertrophies and their diameter is more than doubled, so that, under favorable conditions, they can be palpated through the abdominal wall.

Tubes and Ovaries.—These structures are drawn up out of the pelvis by the enlarging uterus and after the fourth month are situated in the abdominal cavity. The tubes are considerably elongated and show a slight hypertrophy of the muscle layers and at times a decidual reaction of the mucosa, but otherwise they are but little changed.

As has already been mentioned, the corpus luteum in the ovary increases in size during the early weeks of pregnancy; later it gradually becomes smaller, but continues as a functioning gland until late in the puerperium. Its antagonistic effect upon the rest of the organ prevents the further development of the follicles, so that ovulation does not occur until some time after the child has been born.

Vagina.—The only changes in the vagina are the result of the increased blood flow to the pelvic organs. Congestion of the superficial vessels causes the mucosa to assume the bluish or violet color so characteristic of pregnancy, and considerably increases the amount of vaginal secretion, which becomes more acid in reaction and acquires marked bactericidal properties. The acidity is due to lactic acid produced by the harmless bacteria, which multiply rapidly and effectually destroy most pathogenic organisms which may be introduced.

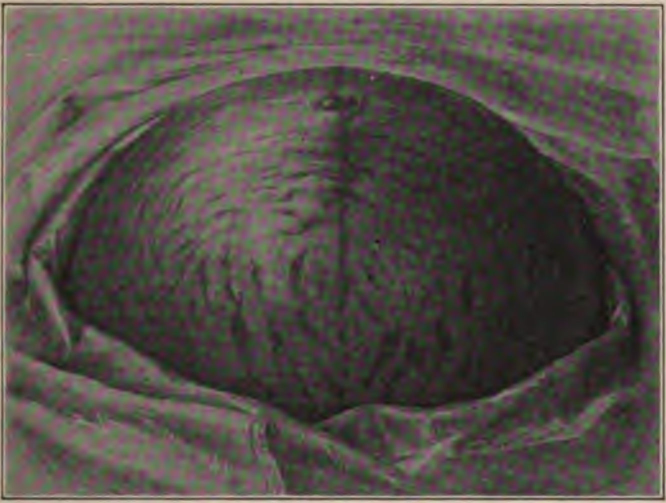


Fig. 40.—Abdomen of primipara at term, showing striations.

Abdominal Walls.—As the uterus grows upward, the abdomen becomes greatly distended and its walls are considerably stretched. In about ninety per cent of all primiparae, the deeper layers of the skin give way under the tension, and irregular depressed lines become visible —the *striae of pregnancy*. The striae vary decidedly in length, breadth and position, and are usually confined to the lower anterior abdominal wall, but occasionally are visible on the buttocks and thighs. As they likewise occur in other conditions associated with rapid growth of the abdominal contents, they are not pathognomonic of pregnancy. Recent striae have a reddish color, but after some months they become silvery white in appearance. In multiparae one may find the red striae from the present pregnancy mingled with the white scars from a previous gestation.

Separation of the recti muscles of the anterior abdominal wall frequently occurs as the result of its rapid distention, and may give rise to a permanent diastasis. In such circumstances, when the patient lies on her back and attempts to raise the head or legs, the recti contract and their median margins become visible and enable one to estimate roughly the degree of separation. In practically every woman near term, some separation may be noted, while, in extreme cases, it amounts to 5.0 to 10.0 centimeters (2 to 4 inches), and the enlarged soft uterus may bulge out between the muscle borders.

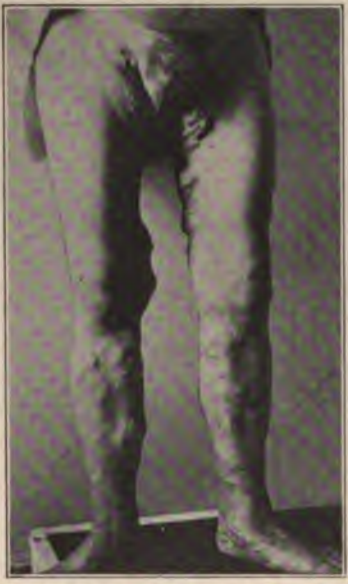


Fig. 41.—Large varicose veins of legs and vulva—multipara. (Photograph.)

Pressure on the veins draining the pelvis and lower extremities very often results in a venous stasis, which produces an edema of the feet and ankles and occasionally of the lower portion of the abdominal wall. Varicose veins of the vulva and the legs are the result of similar interference with the circulation. Unless these symptoms become very prominent they are of no importance.

Breasts.—Early in pregnancy the breasts become full and tense—an exaggeration of the phenomena occurring in the premenstrual period. During the third month they increase quite markedly in size due to actual hypertrophy of the gland tissue, and the blood supply is augmented. In blonde women, the small veins just beneath the skin become dilated and form a delicate blue tracery. The gradual growth of the glands continues throughout pregnancy and in certain patients the overlying skin becomes striated under the increased tension. The areolae increase in size and darken in color and Montgomery's follicles become more prominent. At times the skin just outside the areolae shows a slight pigmentation, which gradually fades away into the normal skin about the periphery. Such *secondary areolae* are more pronounced in dark-skinned women. The nipples become larger and their erectile character becomes so pronounced that a gentle stroke is sufficient to make them stand out from the surrounding areolae. After the fifth or sixth month gentle massage of the gland will cause a thin yellowish fluid called *colostrum* to exude from the nipples. This is the precursor of the milk, which does not appear until the third day following delivery. The colostrum becomes more abundant as pregnancy advances, but its presence is not pathognomonic, because it may appear in the breasts in the course of various diseases of the pelvic organs, and may persist for months or years after lactation.

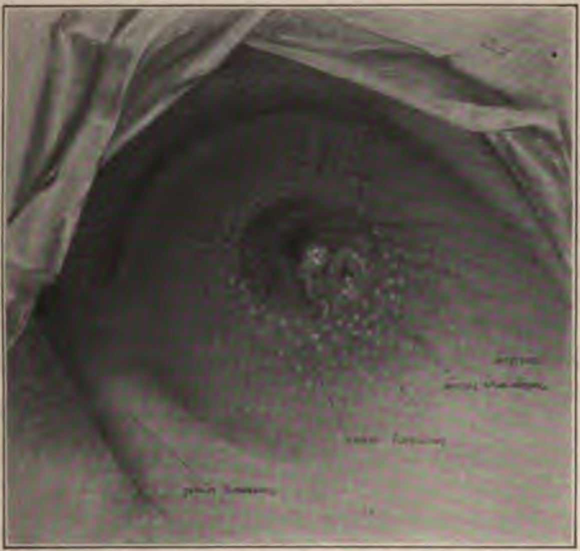


FIG. 42.—Normal breast showing changes due to pregnancy.

The changes in the mammary gland are due to the presence of some substance circulating in the blood, and not to a special nervous mechanism, as was formerly thought.

The changes observed in other parts of the body are not as pronounced as those in the organs already mentioned, but will be briefly considered, in order to complete the picture.

Heart.—There is considerable evidence to show that this organ undergoes a slight hypertrophy during pregnancy. Gradually the work required of it increases and its muscle develops to meet the added burden. During the puerperium there is a slow return to normal.

Towards the end of pregnancy the enlarged uterus presses on the contents of the thorax and the apex of the heart is pushed upward and to the left, so that it comes to occupy a more horizontal position.

The Blood.—Determinations of the amount of circulating blood are not especially accurate, but the best available methods show a definite increase during the latter months of pregnancy, with a slow return to normal after delivery. The increase amounts to about ten per cent, and is probably a prophylactic measure to guard against danger from the loss of blood during labor.

There is no change in the number of red blood cells or the amount of hemoglobin, but the leukocyte count rises just before labor. The former may fall during labor by reason of the loss of blood during the third stage, but quickly regain their normal figures, while the white blood cells decrease in the puerperium unless an infectious process develops. There may be a slight leukocytosis in the early part of lactation. This, however, is only temporary, and may be regarded as physiological.

For some unknown reason, the acidity of the blood rises to a point beyond the ordinary range of normal, but does not give rise to symptoms of an acidosis. The usual nitrogenous constituents of the blood are within the normal limits of concentration, and, although certain unusual substances are undoubtedly present, they are known only by their effects. The *Abderhalden test for pregnancy* is based on the action of one of these unknowns upon placental protein.

Respiratory Tract.—*A priori,* it would seem certain that mechanical interference with breathing must result from the upward pressure of the enlarged uterus late in pregnancy, but the decrease in height of the thoracic cavity is so well compensated by an increase in its breadth that the lung capacity is somewhat augmented rather than diminished. The relation between the oxygen taken in and the carbon dioxid expired remains practically unchanged, whereas the quantity of air passing into the lungs is considerably increased, thus insuring excellent ventilation of the blood. Near the end of the ninth month, when the uterus reaches its highest point, shortness of breath on exertion is frequently experienced by the patient.

Digestive Tract.—Toxins elaborated in connection with the growing ovum often produce digestive disturbances, as evidenced by the frequency with which nausea and vomiting are associated with pregnancy.

This condition will be discussed later. During the second half of gestation, about fifty per cent of pregnant women suffer from constipation as a result of the pressure of the growing uterus upon the lower intestine.

Urinary Tract.—Even though the added burden of excreting the waste materials from the fetus is imposed upon the mother's kidneys, they are normally quite equal to the task. Consequently, any evidence of renal insufficiency, such as a decrease in the amount of urine or the presence of albumin or casts, should be considered serious and demands the immediate attention of the physician.

As the early pregnant uterus enlarges, it presses against the neck of the bladder and causes the patient to desire to void at frequent intervals. During the fourth month, after the fundus has ascended into the abdominal cavity, the pressure is relieved and does not return until the last weeks of pregnancy, when the descending head acts in much the same manner and inaugurates another period of increased frequency of micturition.

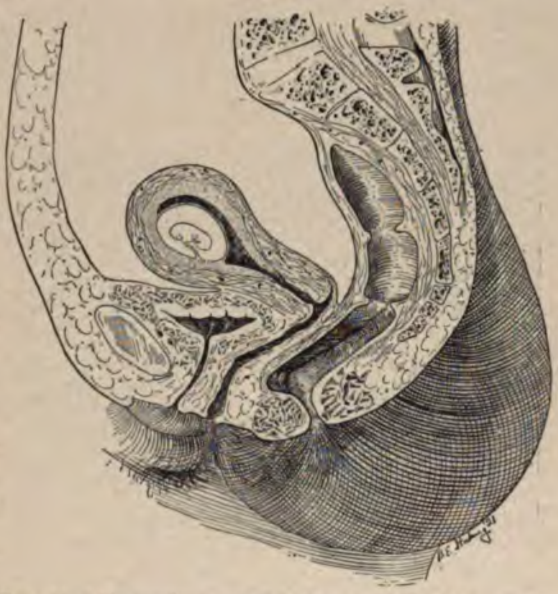


FIG. 43.—Six-weeks pregnant uterus with fundus pressing upon the bladder. Diagrammatic.

The Ductless Glands.—The thyroid, parathyroid and adrenal glands, as well as the hypophysis, or pituitary body, regularly become somewhat enlarged during gestation and are supposed to pour into the blood stream increased amounts of their internal secretions. The reasons for this heightened functional activity, and the specific effects of the different secretions, are little understood. As has already been indicated, these glands are parts of the endocrine system, in which the ovaries are supposed to play an important rôle, and it is probable that the changes which occur in the latter are compensated for by the activity of the other ductless glands.

Skeleton and Teeth.—Softening of the teeth associated with an increased tendency to decay is so common in pregnant women that the laity are familiar with the phenomenon, and the old saying "for every child a tooth" expresses the popular conception. The skeletal bones likewise become more porous, but the lessened strength of the bony framework of the body is rarely sufficiently pronounced to produce symptoms.

The increased blood supply to the pelvis, incident to pregnancy, results in greater vascularity of the pelvic joints and leads to their relaxation, which occasionally is so extreme as to interfere with locomotion.

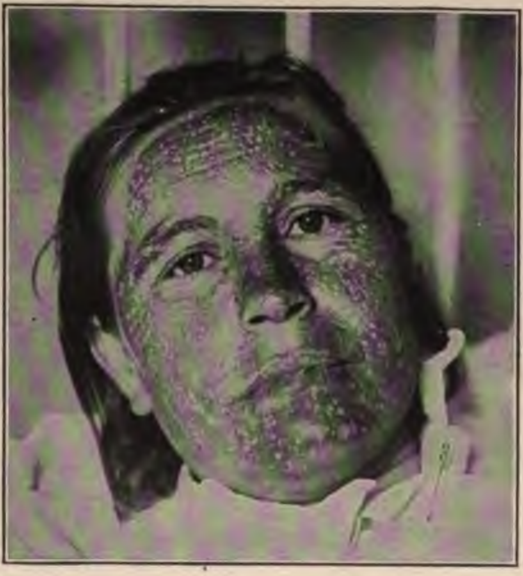


FIG. 44.—Cloasma. (Cragin.)

The Skin.—Deposits of pigment in the deeper layers of the skin appear not only in the areolae of the breasts, but also in the mid-line of the abdomen, which, especially in its lower portion, becomes definitely darker than the surrounding skin. Likewise, irregular areas of the face and neck become pigmented and appear as light brown or yellowish splotches. This condition is called *cloasma* and is recognized by the laity as a sign of pregnancy. All trace of such pigmentation gradually disappears after delivery. The pigment concerned is an iron-containing substance, which is perhaps intended to serve as a reserve supply of iron during the puerperium, when that element may be needed to replenish the blood lost during labor, as well as to supply the demands of the infant by way of the milk.

The glands of the skin exhibit increased activity during pregnancy and possibly relieve the kidneys of some of the excretory burden. Diminished perspiration may be a danger signal and should not be ignored.

General Metabolism.—Pregnancy is no longer looked upon as a period of tissue sacrifice on the part of the normal pregnant woman for the sake of her child, for careful observations have shown that she actually gains in weight, exclusive of the enlargement of the various organs. The total gain is ordinarily about thirty pounds (ten to fifty pounds), but, as only one-half of it is accounted for by the hypertrophy of the uterus with its contents and the breasts, the remainder is scattered through the body as a reserve material which may be called on during labor or lactation.

Early in pregnancy there is frequently a slight loss of weight, associated with bodily and mental lassitude, but in the later months the patient usually feels more robust in body and more normal in mind and begins to increase in weight. Naturally the amount gained depends somewhat upon the size of the individual, but, on the average, it amounts to three to five pounds per month during the second half of pregnancy. If a progressive increase does not occur during this time, it is evident that the fetus is growing at the expense of the mother, which should be avoided, if possible.

Nature has endowed the pregnant woman with an especially economical metabolism to facilitate this storage of the essential food elements, and accurate chemical investigations have demonstrated that, upon a diet no more extensive than in the non-pregnant condition, she is able to store considerable quantities of various materials. Nitrogen, calcium, phosphorus, etc., are excreted in relatively diminished amounts, so that the balance is usually in favor of the prospective mother. If, however, for any reason, the woman cannot or will not eat sufficient food, fetal development proceeds uninterruptedly, with the result that the needed substances are obtained from the maternal reserves. Fortunately, most women have a good appetite during the greater part of pregnancy, and, consequently, this sacrificial tendency is not utilized.

Diagnosis of Pregnancy.—In the great majority of cases, the patient has recognized her condition before she consults a physician, but occasionally determination of the existence of pregnancy may be extremely difficult. Various symptoms and signs are indicative of pregnancy in the early months, but it is not until the middle of gestation that an absolute diagnosis can be made. The four positive signs, which become available at this time, are due directly to the fetus itself, whereas the objectively determined changes, known as probable signs, represent alterations in the mother's body due to the presence of the growing ovum. The presumptive signs are mostly subjective in character and therefore still less reliable.

POSITIVE SIGNS OF PREGNANCY

1. Ability to palpate the outlines of the fetus.
2. Perception of its active and passive movements *in utero.*
3. Hearing the fetal heart beat.
4. Detection of fetal bones by the X-ray.

Outlining the Fetus.—By palpation through the abdominal walls, it is possible to feel the various parts of the fetus, such as the head, back and extremities. The fetus must be quite large before this is possible and therefore, as a diagnostic sign, it is useful only during the last third of pregnancy.

Fetal Movements.—As has been stated, fetal movements become perceptible to the mother during the fifth month, as gentle quiverings within the lower abdomen—"quickening." They soon become more marked and later may be so pronounced as to annoy the patient. From the sixth month onward they can be felt at intervals by the hand placed upon the abdomen. When thus objectively recognized as *active movements,* they are diagnostic of pregnancy.

Passive movements are obtained by ballottement, either through the vagina or the abdominal walls. The parts of the fetus suspended in the amniotic fluid react to sudden pressure very much as does a piece of ice in water. If the head or one of the extremities is quickly tapped by the fingers through the vault of the vagina or the abdominal wall, it moves away and then rebounds against the finger, the phenomenon being called *ballottement.* This sign is not as reliable as is the detection of active movements.

The Fetal Heart.—Development of the heart begins at an early stage, but the sounds due to its contractions are so faint that they cannot be heard by the examiner until the middle of pregnancy. During the fifth month (sixteen to twenty weeks) a practiced observer can usually hear the rapid double sound caused by the contracting heart, and is thus enabled to say positively that pregnancy exists. When the abdominal wall is unusually thick, or there is an abnormal amount of amniotic fluid, the heart sounds are more difficult to hear, and may not be audible until some weeks later. At first the sounds are audible only over a small area of the abdomen and during the search for them each square inch over the uterus must be auscultated. Later, however, they are heard over a larger area and are easily detected. The location of the sounds may vary from time to time, as the fetus changes its position. Ordinarily, as the back of the child is in close contact with the uterine wall, the heart sounds are best heard through it, instead of through the thorax as after birth. The area through which they are best heard is generally to one side or other of the lower abdomen, depending upon the position of the child. When the fetus is small it is more convenient to employ a stethoscope, but, during the last trimester, the ear placed directly upon the abdomen is quite as satisfactory. A square of soft, thin, cotton material may be used as a sounding towel.

The fetal heart sounds are best described as resembling the muffled ticking of a watch heard through a pillow. Two sounds are audible with each heart beat just as in the adult, but, as the second is so much more pronounced than the first, the latter is disregarded in counting the pulse rate. Individual variations in rate occur, but commonly it is between 120 and 140 per minute. During pregnancy the rate may vary within wide limits for no apparent reason, but during labor a fall to below 100 or a rise above 160 usually indicates some interference with the fetal circulation that may end fatally if delivery is not promptly effected. It has already been stated that the rate of the heart does not indicate the sex of the child.

A trained observer rarely mistakes the other sounds within the abdomen of the pregnant woman for the fetal heart sounds, but occasionally the desire to hear them so influences the imagination that one may suppose that they are heard and may even count them, notwithstanding the fact that the child has long been dead.

Among the sounds sometimes heard on auscultation over the uterus, we may mention:

1. The funic souffle.
2. The uterine souffle.
3. Movements of the fetus.
4. The transmitted impulse from the aorta.
5. The passage of gas through the intestine.

The *funic souffle* consists of a blowing sound synchronous with the fetal heart beat. It is only rarely audible, and, when heard, is usually so transient that it cannot well be demonstrated. Apparently it is due to an interference with the flow of blood through the umbilical arteries, for it can occasionally be elicited by making pressure over the cord with the stethoscope. Many physicians consider that a persistent funic souffle indicates the beginning of fetal asphyxiation due to pressure on the cord, but this is not the case.

The *uterine souffle* results from the rush of the blood through the dilated and tortuous uterine vessels and is heard as a soft, blowing murmur synchronous with the maternal pulse. In most patients it can be heard at one time or another in the lowermost part of the abdomen. As any pathological enlargement of the pelvic organs which is associated with marked hyperemia may give rise to a similar sound, the uterine souffle is of little value to the obstetrician. On the contrary, it may be a distinct disadvantage in that it may mask the fetal heart sounds and render it very difficult to count them with any degree of accuracy.

Fetal movements, as such, probably do not make a sound, but may create an impulse which is carried to the ear and can be appreciated by that organ. They are rarely confusing.

Pulsations of the aorta, especially in nervous individuals, may be propagated through the uterus and may communicate a distinct throb to the listening ear. The sound element in these impulses is probably minimal. They are usually best appreciated in the mid-line, and consequently rarely affect auscultation of the fetal heart.

Passage of gas and liquid through the maternal intestines causes various gurgling sounds which may be audible at a distance of several feet. Whether of greater or less intensity, they may prove very annoying by interrupting a count of the fetal heart rate.

Detection of Fetal Bones by the X-Ray.—From the middle of pregnancy onward, it is generally possible to detect, in an X-ray plate of the lower abdomen, the shadows cast by the fetal bones, and such evidence affords absolute proof of pregnancy. In the presence of very thick abdominal walls or of even a moderate degree of hydramnios, the penetration of the rays is so interfered with that it may not be until the seventh or eighth month of pregnancy that the shadows become sufficiently well differentiated to make the sign available. This method of diagnosis is of no value in the first half of pregnancy, since the fetal bones are too poorly calcified to cast shadows that are sufficiently sharp to be differentiated from those made by the maternal structures.

PROBABLE SIGNS OF PREGNANCY

The probable signs of pregnancy are the following:

1. Enlargement of the abdomen.
2. Changes in size, shape and consistency of the uterus.
3. Changes in the cervix.
4. Intermittent uterine contractions.

Enlargement of the Abdomen.—In a woman of the child-bearing age this should always suggest the possibility of pregnancy. Other signs and symptoms will usually have developed before this evidence becomes available in the fourth month, but when the menses are suppressed, as during lactation, it may be the first sign to direct attention to the pelvic organs.

Primiparous individuals have less pronounced enlargement than multiparae. This is due to the fact that the prolonged distention during the first pregnancy so stretches the abdominal muscles that they do not regain their original tone, and, consequently, in subsequent pregnancies, the relaxed walls yield more readily to the growing uterus, and this leads to a more noticeable increase in size of the abdomen. After repeated child-birth, the muscle walls may become so flaccid that they offer practically no support to the uterus, with the result that the organ sags forward and gives rise to a pendulous abdomen. Even in first pregnancies, when the patient is lying horizontally, the uterus is

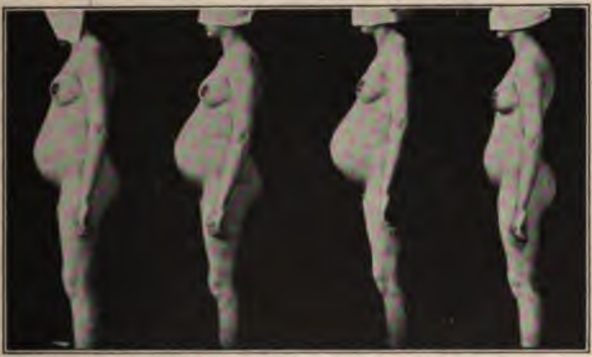

8 months. 9 months. 10 months. 2 weeks after delivery.

Fig. 45.—Series of photographs of the same patient to show the abdominal enlargement at various periods.

in contact with the vertebral column, and, consequently, the abdominal tumor is less prominent than when she is standing erect.

Changes in the Size, Shape and Consistency of the Uterus.—These are the only physical signs available during the first three months and their detection alone makes it possible to say that pregnancy probably exists.

The detection of an enlarged uterus on vaginal examination, together with the history of a cessation of the menstrual flow, ordinarily allows the diagnosis to be made. The early growth is relatively slow, and, even at the end of the third month, the uterus is only the size of an orange. The enlargement of the uterus is not symmetrical. At first it retains its flattened pear-shape, but from the eighth week it becomes quite globular in outline. At the same time, the relation between the axis of the cervix and that of the body changes, and the resulting increased anteflexion comes to be one of the very early signs of pregnancy.

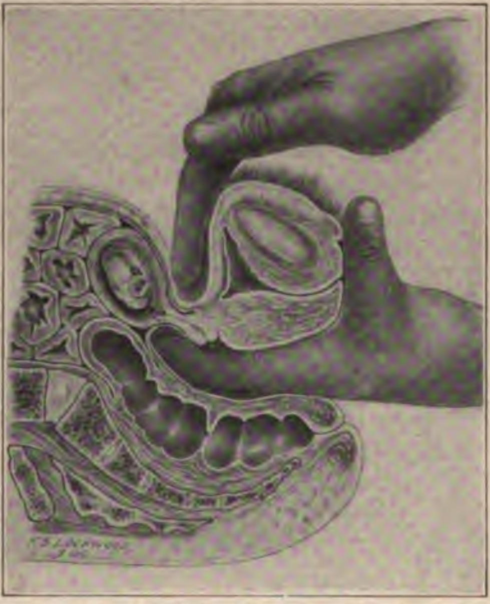


FIG. 46.—Method of detecting Hegar's sign. (Williams.)

Changes in consistency appear during the second month and are very valuable aids in diagnosis. The non-pregnant uterus is firm and elastic, but the existence of pregnancy results in the production of characteristic alterations in definite areas. The narrow zone between the cervix and the body shows such changes at an early date, and its accessibility makes it an important diagnostic sign. On bimanual examination it is possible to feel the firm cervix, and higher up the enlarged elastic body of the uterus, while the isthmic portion between them has become so softened that it can be felt only with difficulty, and occasionally cannot be appreciated. This phenomenon is spoken of as *Hegar's sign.* Its occasional presence in other conditions does not detract from its value.

Changes in the Cervix.—The cervix becomes slightly enlarged and somewhat softer during the second month. To the examining finger, the mucous membrane over the vaginal portion seems thicker and less resistant, even though deep pressure may show the muscular tissue as dense as in the non-pregnant state. Later in pregnancy these changes are more pronounced, and near term the cervix is frequently so soft and pliable as to be distinguished only with some difficulty.

Intermittent Contractions of the Uterus.—Ordinarily, the pregnant uterus is tolerably soft in consistency, but from the second month onward, on bimanual vaginal examination, it can at intervals be felt to become firm and boardlike in consistency, and after maintaining this condition for a few moments it relaxes and returns to its usual condition. These changes are due to intermittent contractions of the uterus, which are known as *Braxton-Hicks contractions.* They recur at five to fifteen minute intervals throughout pregnancy and after the middle of gestation can be detected through the abdominal wall. Their painless character and short duration alone distinguish them from labor pains. As pregnancy advances they become more noticeable and may be appreciated by the patient, even though they are not accompanied by actual discomfort.

PRESUMPTIVE SIGNS AND SYMPTOMS

The presumptive evidences of pregnancy are largely subjective and are therefore of relatively little value to the physician. The signs already mentioned have much greater diagnostic import because they are objective in character and can be appreciated by the physician on examination, while the present group embraces various subjective factors which are noted by the patient and which may be utilized by her in diagnosing her own condition. Despite the fact that they may sometimes result from other conditions than pregnancy, they are very useful, especially when several of them are present at the same time.

Cessation of Menstruation.—In healthy women whose menstrual function has always been regular, its failure to appear at the expected time constitutes the most characteristic subjective evidence of pregnancy; while if more than one period has been missed the value of the symptom is still further enhanced. Deep emotions as grief or fear, as well as changes in climate, may sometimes result in the suppression of one period, but generally the flow is reëstablished the second month and no other suggestive symptoms are noticed. On the other hand, the sign is of less value to physicians, for the reason that it depends upon the veracity of the patient, and it sometimes happens that she may make false statements in an attempt to conceal her condition, or to induce the physician to undertake some procedure which would not be justifiable if he knew that pregnancy existed. For example, a woman who knows that she is pregnant but does not wish the condition to continue, may claim that she is suffering from excessive bleeding in the hope that the physician may recommend a curettage, which will inevitably end it.

Absence of the menstrual flow is so associated with the pregnant condition in the lay mind than even when menstruation ceases naturally at the end of sexual life many women may imagine various other symptoms and become convinced that they are pregnant. These cases of *pseudocyesis* or *false pregnancy* are discussed later.

The question of occurrence of menstruation during pregnancy is a mooted one. Unquestionably, certain women do have a slight discharge of blood from the vagina at the usual menstrual interval for several months after conception, and anatomically there is no reason why menstruation should not occur up to the fourth month of gestation, at which time the decidua capsularis fuses with the decidua vera and by obliterating the uterine cavity renders it impossible. Most physicians, however, believe that this is not a normal flow, and consider that the discharge is evidence of a threatened miscarriage. The bleeding usually varies from the normal in amount and appearance as well as in its shorter duration, and may lead the patient to think that everything is not as it should be.

Changes in the Breasts.—These have already been described earlier in the chapter. In primiparae they should be regarded as important diagnostic signs, even though various pelvic tumors may bring about similar alterations. In multiparous women, on the other hand, they are of little value; as in them, the glands may contain a fluid resembling colostrum, which can be expressed by massage, for months or even years after the last child has been weaned.

Nausea and Vomiting.—Approximately one half of all pregnant women will present these symptoms sometimes during the course of pregnancy. The nausea may be noticed at any time during the twenty-four hours, and may or may not lead to actual vomiting, but the most usual time for its occurrence is in the morning just after arising, hence the expression "morning sickness." Although some women are annoyed by this symptom almost from the day of conception, it usually does not appear until after the first period has been missed and then continues for two or three months. Occasionally, patients are troubled all through pregnancy, and obtain little relief until after delivery, when the condition spontaneously disappears. The severity of such symptoms in one pregnancy affords no criterion as to what may be expected in a subsequent one.

It is probable that during pregnancy there is a toxin circulating in the blood which tends to produce nausea and vomiting; but that the tendency in this direction is very slight unless the action of the toxic substance is accentuated by an unstable nervous equilibrium. The most common form of pernicious vomiting occurs in individuals with poorly balanced nervous systems and is amenable to suggestive treatment, thereby indicating the presence of a mental element behind the physical condition.

It has seemed recently that "morning sickness" is becoming less common and certainly the cases of pernicious vomiting are less numerous. The nervous element in many of these latter has long been recognized, but little emphasis has been laid upon the probability of a mental origin of the former group. It is not unreasonable to suppose that the universal knowledge, among women, that pregnancy causes gastric disturbances, should react upon even healthy individuals to induce nausea and vomiting. Advice and suggestion regarding the needless inconvenience resulting from this supposedly necessary accompaniment of child-bearing will very often permit a woman to escape its annoying features, and perhaps when the mental attitude of the mass of people is sufficiently enlightened the nausea of pregnancy will cease to exist except as a distinct pathological entity.

Quickening.—The active movements of the child *in utero,* as perceived by the mother, constitute the phenomenon of "quickening." This symptom is ordinarily noted about the eighteenth to twentieth week, but occasionally women will insist that they "feel life" as early as the twelfth or even the tenth week. In pseudocyesis, the supposed perception of fetal movements most probably results from the passage of gas through the intestines, although women who have been pregnant say there is no similarity between the two sensations.

Discoloration of the Vaginal Mucosa.—The blue coloration of the vaginal mucous membrane, which may be observed from the early months of pregnancy, is known in this country as *Chadwick's sign,* from the physician who particularly called attention to it. It is generally most pronounced in the region immediately posterior to the urethral orifice.

Changes in the Skin.—Pigmentation of the areolae and the linea alba, the presence of cloasma and the development of striae are not characteristic of pregnancy alone, but, in conjunction with other changes, they are occasionally of some value.

Urinary Changes.—The increased frequency of micturition in the early months of pregnancy frequently attracts the patient's attention and may even cause her to consult a physician.

Mental Changes.—More particularly in the early months, the entire mental attitude of the woman may be altered, so that she will become depressed and irritable and will cry upon the slightest occasion. Lack of memory and incapacity for mental effort are very common. The taste for food may be so affected that there is a pathological craving for unusual and even indigestible articles of diet.

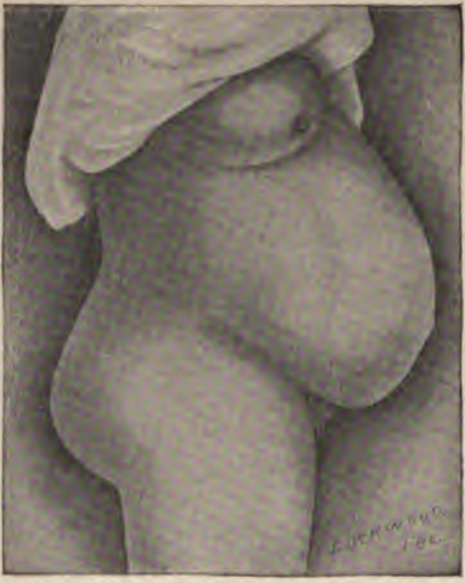


Fig. 47.—Pseudocyesis—abdominal enlargement due to fat. (Williams.)

Pseudocyesis or Spurious Pregnancy. — Pseudocyesis is a condition in which a woman fancies herself pregnant and presents many of the symptoms that normally accompany pregnancy. One of two classes of women are usually affected: those who reach the menopause earlier than they anticipate, and those who are sterile in spite of a great desire for offspring. They present many of the usual symptoms of pregnancy but none of the objective signs, and consequently the diagnosis is relatively simple; but great difficulty may be experienced in convincing the patient that her own diagnosis is incorrect.

Signs of a Previous Pregnancy.—It is sometimes of importance to be able to determine whether a patient has previously borne children. Practical difficulties are offered by the fact that many of the signs that ordinarily are utilized as evidence of a previous pregnancy and labor may have been the result of other conditions or of operative manipulations. The presence of old striations on the abdomen or breasts, as well as evidences of a healed laceration of the perineum are very suggestive, but the most characteristic sign is the detection of old scars in the cervix. Simple instrumental dilatation of the cervix, preceding a curettage, may leave similar traces, so that the possibility of such a procedure must be eliminated before a positive statement can be made.

During pregnancy additional evidence may be afforded by the early dilatation of the external os, so as to admit the finger tip, as well as by the failure of the head to descend into the pelvis prior to the onset of labor. A relatively short and easy second stage of labor likewise is of some value in confirming such an opinion.

Diagnosis of Life or Death of the Fetus.—After pregnancy has been definitely diagnosed, the fetus is presumed to be alive until very definite evidence has been adduced to the contrary. In the majority of cases of fetal death the uterus reacts to the dead child as to a foreign body and expels it by regular uterine contractions. Such an eventuality naturally eliminates the necessity for a careful diagnosis. When, however, the fetus is not promptly expelled after its death, the diagnosis may present considerable difficulty. In the early months, recourse must be had to frequent examinations over a period of several weeks, and, if there has been no appreciable increase in the size of the uterus during four or six weeks, it is safe to assume that the ovum has died and measures should be taken to empty the organ artificially. In the later months, after "life" has been felt, the patient's suspicions are aroused by the absence of fetal movements. An objective diagnosis is possible only when repeated examinations fail to detect the fetal heart beat or active movements, or when the uterus fails to correspond to the duration of pregnancy as computed from the menstrual history. Fetal death may produce such symptoms as foul taste in the mouth, a tired feeling or a sensation of weight in the abdomen, but they are not sufficiently characteristic to be of much value.

Multiple Pregnancy.—Occasionally, the uterus contains more than one ovum or fetus, and there is no reason to believe that the condition is abnormal. In a few recorded instances, as many as six ova have found lodgment in the uterus at the same time, but a greater number than three is extremely rare. Depending upon the number of embryos present we speak of twin, triplet, quadruplet, quintuplet and sextuplet pregnancy.

The incidence of multiple pregnancies varies in different countries, being higher in the colder regions than in the tropics. A convenient rule for remembering the relative frequency of multiple pregnancy is as follows: twins occur once in eighty pregnancies, triplets once in eighty squared, quadruplets once in eighty cubed, and so on. Calculated by this method the results are: twins 1 in 80; triplets 1 in 6400 and quadruplets 1 in 512,000. These figures agree fairly well with those obtained from actual statistics. Multiple pregnancies are noted somewhat more frequently in multiparous individuals than in primiparae. Heredity seems to play a part in the etiology of the condition, the tendency usually being transmitted through the female members of a family. Occasionally the male is apparently responsible, as in the somewhat doubtful case of a Russian who was the father of eighty-seven children by two wives. The first bore four sets of quadruplets, seven of triplets and sixteen of twins, while the second had two triplet and six twin pregnancies.

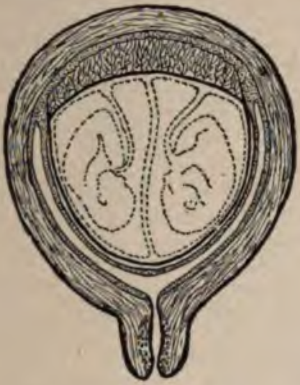
Twin pregnancy will be discussed in some detail, but the other types occur too rarely to be of any great interest.

Twin pregnancies are divided into two groups: *single ovum twins* and *double ovum twins*. About seventy-five per cent of the cases are in the latter class.

Single ovum twins probably result from a splitting of the early fertilized ovum into two equal portions, each of which goes on to complete development. The children are always of the same sex and of such similar physical appearance that they are commonly designated as "identical twins." In such cases there is but one placenta, in which the two fetal circulations are directly connected, while there are two separate amniotic sacs, one for each fetus, but only a single chorionic membrane surrounding the two.

Double ovum twins are due to the simultaneous fertilization of two separate ova, which enter the uterus at the same time and develop side by side. There are two placentae with chorion and amnion complete, but, even when the two placentae are fused into a single one, there is never any anastomosis between the vessels of the two organs. The children may or may not be of the same sex and resemble one another no more than do ordinary brothers and sisters.

Twins are generally smaller than other full-term children, but their combined weight is commonly greater than that of the usual single child. Not infrequently the marked distention of the uterus results in the termination of pregnancy slightly before the end of ten lunar months and the small size of the children can be explained by their prematurity. It is not unusual for one child to be considerably larger



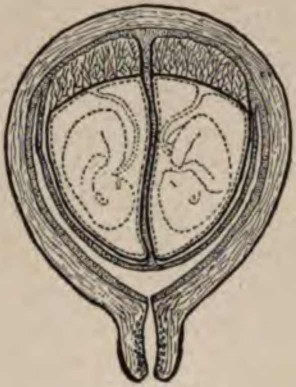


Fig. 48. Fig. 49.

Fig. 48.—Single-ovum twins. Schematic. Single chorion, placenta and decidua capsularis, but two amnions.

Fig. 49.—Double-ovum twins. Schematic. Double chorion, amnion and decidua capsularis with two placentae fused into one mass.

than its fellow, and in extreme cases the smaller infant may be less than half as large as the better developed.

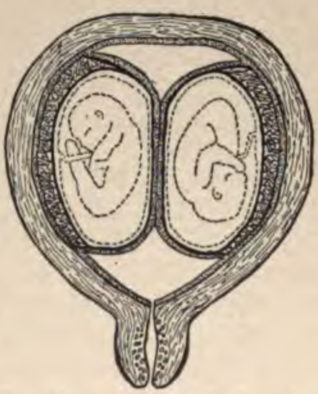


Fig. 50.—Double-ovum twins. Schematic. Double chorion, amnion and decidua capsularis with two separate placentae.

Practically all possible combinations of presentation and position have been described in twin pregnancy, and the course of labor depends largely upon the conditions obtaining in the individual case, but, generally speaking, the danger associated with it is not excessive.

The diagnosis of twins is made by palpating distinctly two separate fetuses in the course of abdominal examination or, better, by hearing and counting two fetal hearts. To be distinctive, the two sets of heart sounds should be heard over different parts of the uterus and their rates must vary by at least ten beats per minute, since hearing the heart of a single child over two different areas might lead to an erroneous diagnosis.

Superfecundation means the fertilization of two ova within a short period but not at the same coitus. It undoubtedly occurs, as is conclusively proven by the rare instances in which a woman gives birth to a white and a mulatto child, or to a syphilitic and a normal child at the same labor.

Superfetation is the term applied to the possible implantation of a second fertilized ovum in a uterus in which one embryo is already developing. Until the uterine cavity is completely obliterated at the end of the fourth month, such a circumstance is theoretically possible, but, as yet, no conclusive evidence has been adduced that it ever occurs. The usual arguments favoring the theory deal with the variability in size of twins, but in most instances such differences can be satisfactorily explained by conditions affecting the blood supply of the two embryos.

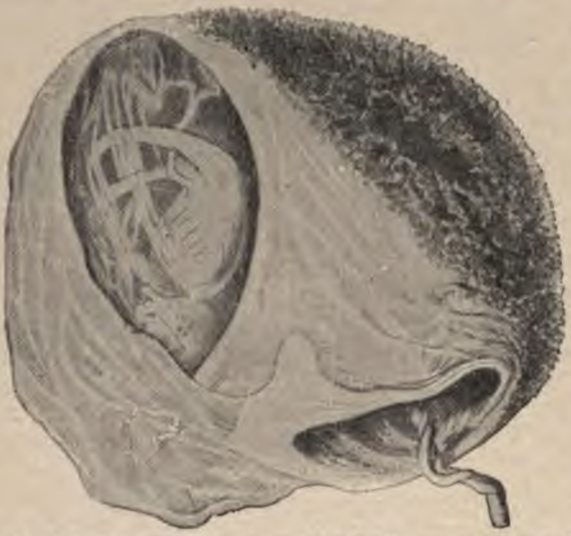


Fig. 51.—Fetus papyraceous attached to membranes of living child. (Williams after Ribemont-Dessaignes.)

Occasionally one twin perishes *in utero* during the early months of pregnancy and is crowded over to one side of the cavity by the surviving fetus. The former atrophies, becomes mummified, and is gradually compressed until it forms a flattened mass lying between the uterine wall and the membranes of the living child. When the after-birth is expelled during labor, the *fetus papyraceous* or *compressus* is found adherent to the membranes. Very exceptionally, in the case of double ovum twins, one may die and be expelled from the uterus along with its placenta, while its fellow goes on to full development. In single ovum twins, such an outcome is impossible, because of the connection between the two placentae.

CHAPTER V

PRENATAL CARE

The introduction of antiseptic and aseptic technic and the development of reasonable operative procedures have marked the advance of the art of obstetrics during the nineteenth century. The result has been the reduction of the former appalling maternal death rate from puerperal infection to a point where maternity is relatively safe. At present uncomplicated delivery rarely leads to a fatal issue, the majority of deaths resulting from the more unusual and less understood complications. After the application of surgical principles had reduced the death rate from infection and from operative interference to relatively minimal proportions, progressive obstetricians turned their attention to the prevention of disease.

Prenatal care, as it is called, is in large part a twentieth-century development and is progressing side by side with general preventive medicine. By careful supervision the mother can be protected from some of the most serious complications of pregnancy and labor, while the child is not only given a better chance of being born alive and strong, but the probability of its development into a useful member of society is materially increased.

Emphasis has already been laid upon the conception that childbearing represents the highest normal function of the human female, but that does not preclude the necessity for great care. The changes incident to pregnancy are numerous and extensive, and sometimes bring to light hidden weaknesses, which might otherwise not have become manifest, or only have appeared later in life. Intelligent supervision aims to discover these weak links and to treat them in such a way as to prevent serious breaks.

Within the past few years the obstetrical clinics have appreciated the special need for such care among their patients, who come mostly from the poorer classes, and employ specially trained workers to carry the doctrines of prevention into the homes, as well as to see that they are followed. They likewise insist upon frequent medical examinations and can adduce proofs that the results obtained fully justify the effort and money expended.

The general principles involved in prenatal care are based upon prophylaxis and the intelligent attention to comparatively minor details, and this chapter will be devoted to the consideration of the various hygienic problems of the pregnant woman, as well as to the significance and relief of the minor ailments which may occur during the course of pregnancy.

Choice of a Physician.—Fortunately, the days are passing when a woman, having failed to consult a doctor during pregnancy, summons whomever she can find after she has fallen into labor. There is no time when careful and sympathetic supervision are more useful than during the nine months of pregnancy, and *every prospective mother should put herself under the care of a competent physician as soon as she is aware of her condition.* He will examine her at regular intervals and will always be available to give advice and to quiet her fears. The actual choice of a doctor is, of course, a matter of personal preference and cannot be discussed here, but, generally speaking, a competent specialist is better equipped for his own particular kind of work than the general practitioner.

Hospital or Home Care.—This choice should be made at the first visit to the doctor. If the hospital is chosen, it will be necessary in most cities to engage accommodations five or six months before the expected date of confinement, as hospital facilities are too limited for the number of patients who desire to utilize them, so that the rule of "first come, first served," is generally adopted. Delivery in the home likewise requires a certain amount of preparation and forethought. The decision is not easy and various factors must be considered. Hospital treatment is to be preferred for primiparous patients, and especially for those who present some abnormality, because of the better equipment for operative work and on account of the constant presence of trained assistants. It is also somewhat less expensive when everything is taken into consideration. Many patients, however, prefer to stay at home, and in such cases the services of a competent nurse must be engaged some months before they will be needed.

THE HYGIENE OF PREGNANCY

Certain problems arise so commonly during the course of pregnancy that those doing obstetrical work should be prepared to give sane advice.

Most of the suggestions, which will be made in this section, represent the application of common sense to the minor points in hygiene, and to the treatment of the simpler ailments.

The Diet during pregnancy need not be particularly different from that taken ordinarily, provided the latter is well balanced and sufficient. It has already been pointed out that nature is so economical of all ingested nutriment, that the pregnant woman need not "eat enough for two." The usual increase in weight naturally calls for a slightly augmented diet, but the demand is only proportional to the gain. Protein, carbohydrate, fat, salt, the accessory factors, and water are required in the usual amounts and in the ordinary ratio. Articles of food which have previously proven indigestible should be strictly avoided, and it is well to abstain from all highly seasoned dishes. Fresh fruit and vegetables are valuable both for their vitamin content and because they form "roughage" which tends to regulate the bowels. If, in the early months, nausea is very annoying, or, in the later months, the enlarged uterus tends to limit the capacity of the stomach, food may be taken between meals. It will frequently be found that five or six small meals rather than three larger ones give great relief and tend to prevent the symptoms attending overloading the stomach. Meat once a day is quite sufficient to meet the animal protein requirements. Thorough mastication of all foods is essential and consequently the meals should never be hurried. Usually, it is better not to eat after the evening meal, so that the stomach may be empty by the time for retiring. Cravings for special articles of diet may be satisfied in so far as they do not involve definitely harmful substances.

Some physicians still believe that the size of the child can be altered by a diet low in carbohydrates and high in protein. This is known as *Prochownick's diet,* from a German who first advocated it, and for a time it had quite a vogue. After more protracted experience, most of its supporters have become lukewarm concerning it, so that it is safe to infer that the average results obtained are negligible. Animal experimentation has shown that the size of the offspring can be controlled by eliminating from the diet certain essentials, such as the vitamins, but it also shows that this reduction lowers the vitality of the young to an alarming extent. No observations on the application of this principle to the human have yet been reported.

Water is as necessary for the body as solid food, and the prospective mother should systematically take somewhat more fluid than at other times. The uterine contents are very largely composed of water, which must be supplied, and moreover it is essential that the output of urine be kept normal. It is difficult to state just how much urine should be excreted in 24 hours, but certainly the amount should not fall below one liter (one quart), while two or three times that quantity is better. During the summer months, when perspiration is more profuse, proportionately larger amounts of fluid should be ingested in order to maintain the urinary output at the same level. Some of the liquid may be taken in the form of milk, tea and coffee, but a considerable amount of plain water should be drunk as a matter of routine. Non-purgative mineral waters are not contra-indicated and frequently constitute an agreeable substitute for plain tap water.

The Body Weight.—At the end of pregnancy, the enlarged uterus and its contents, together with the increased tissue in the breasts, weigh about 15 pounds, which is divided as follows: fetus—$7^1/_4$ pounds; placenta and cord—$1^1/_4$ pounds; amniotic fluid—$1^1/_4$ pounds; enlarged uterus—$2^1/_2$ pounds; and hypertrophy of the breasts—$2^1/_2$ pounds. If the period of pregnancy is not to be one of sacrifice on the part of the mother for the fetus, it is evident that her weight must increase by at least that much during the nine months. As most of this gain comes during the last three months, it is found that the monthly gain during that period averages $3^1/_2$ to 5 pounds. The patient should be weighed at intervals, in order that it may be determined whether she is gaining satisfactorily. A gain of more than the minimum of 15 pounds is to be desired, because it represents so much new tissue held in the body as a reserve against the added demands of the lactation period. The frequent tendency for patients to attempt to prevent any increase in weight is to be deprecated.

The Bowels.—The bowels should be evacuated at least once a day so that the system may not be overloaded by the waste materials which ordinarily are eliminated through that channel. The habit of regular bowel movements is very important and can frequently be cultivated by systematic attempts at the same time each day. The most logical hour is after breakfast, when the involuntary contractions of the intestinal tract are most active as a result of the digestive processes which are in progress. Coarse articles of food, such as whole wheat, cornbread and the various fruits and vegetables, are of great value in that they contain considerable quantities of indigestible material, which stimulates peristalsis. Rhubarb, apples, figs, and other fruits, moreover, contain ingredients which have a mild purgative action. A glass of cold water on arising or a few ounces of orange juice immediately before breakfast is sometimes valuable. Medicinal measures are discussed in the next section.

Work and Exercise.—It is often stated that housework offers the best form of exercise for a woman, and pregnancy does not alter the fact. The heavier tasks should be avoided when possible but the routine work about the home furnishes excellent all-round muscular effort and, moreover, serves to keep the woman from becoming too self-centered. Particular conditions may make it inadvisable, but, as a general rule, light physical work is beneficial. The term "light work" is intended to exclude such duties as laundry, scrubbing or operating a sewing machine by foot-power. Slight but regular muscular activity is demanded and serves to improve the digestion, strengthen the heart and build up the body resistance. Short walks in the open air should be encouraged.

Industrial work by women is becoming more common, and many countries have passed legislation regulating the employment of pregnant women. In general, such laws provide that a woman shall be relieved of her duties four weeks previous to delivery and shall not be allowed to resume them until four to six weeks after the birth of the child. Certain industries, for example, those utilizing lead and phosphorus, are especially harmful, and should be forbidden to pregnant women. The necessity for many women to support themselves, even though they are prospective mothers, makes it inadvisable to attempt any didactic statements. They must work in order to live and the best they can do at present is to find such employment as will prejudice their unborn children as little as possible. There is a crying need in this country for laws to protect pregnant working women and to accord them such financial aid that they and their children may be better cared for.

Those unfortunate women who have no definite duties must depend entirely upon various forms of sport for exercise. Walking calls into play all the muscles of the body and is highly recommended as a sensible and sane mode of exercise. Long tramps are inadvisable, but repeated short strolls, which end before fatigue ensues, are beneficial. The art of walking is being lost in the modern craze for motor vehicles, which offer no compensatory benefits. The great danger in most forms of sport is that the exertion may be so violent as to bring on a miscarriage or a premature labor. Tennis, golf, and swimming may be indulged in with impunity by some pregnant women, but are decidedly harmful to others, because of the jarring and jolting of the uterus. The same may be said of dancing. Horseback riding is even more strenuous and should be avoided. After the abdomen has become quite prominent, participation in most games is subject to such inconvenience that they are generally stopped by choice. It is hard to lay down regulations to govern such things, but the general principle, that all exercise and work should cease before the patient becomes actually fatigued, forms a sensible working rule.

The advisability of motor rides and travel by boat or railway frequently concerns the prospective mother, but here again didactic statements cannot be made. Short automobile rides usually entail no risks, but in the last few months of pregnancy the more or less cramped sitting posture and the irregular jolting tend to make the patient so uncomfortable that such excursions should be limited. Railway travel, particularly at night, in a sleeping car, and journeys by boat are ordinarily attended by little risk. Generally speaking, greater care must be exercised during the first four months, when the ovum is rather insecurely attached to the uterus, and in the last month, when jarring may set up uterine contractions and cause premature delivery. In the interval between the sixteenth and the thirty-sixth week the danger of premature expulsion of the fetus is less than at other periods, so that more freedom of action can be safely enjoyed.

Massage is distinctly useful if the woman is confined to her bed for any reason and is unable to obtain exercise. The abdominal muscles should not receive too much attention because of the possibility of irritating the uterus. Systematic active movements can at times be undertaken by a bed patient, but should always be under the direction of the physician.

Recreation.—Recreation is as necessary as before pregnancy, and may be even more so, if the patient is inclined to worry about herself. The theater and good books should be regarded as reliable and harmless possibilities, while nature study may help make out-door exercise more attractive. For cultivated women, intensive study of a foreign language offers a profitable occupation for spare moments. The only common diversion which is contra-indicated is gossip concerning the dangers of pregnancy and child-birth. The patient's confidantes are generally chosen from among the married women and old ladies of her acquaintance, who delight in rehearsing all the harrowing experiences which have come to their attention. As most of their information is incorrect, such influences are nothing if not harmful and should be avoided.

Sleep and Rest.—The hours devoted to sleep should be somewhat longer than usual, because of the frequent necessity of rising to empty the bladder. Previous mention has been made of the appearance of this symptom during the first three as well as the last two months of pregnancy. A well ventilated room and a comfortable bed are essential. Preference is generally shown for a single bed as being more conducive to sound sleep.

The habit of lying down during the early afternoon, or at any time of the day when there is a sense of fatigue, is to be commended. Rest in the reclining posture is more beneficial than any other, even though sleep does not come. In the last months of pregnancy, when the abdominal muscles become tired from the strain of supporting the enlarged uterus, an hour's rest on a couch or bed will frequently make the patient feel quite refreshed.

Clothing.—During the last three or four months of pregnancy the increased size of the abdomen and breasts necessitates radical changes in the garments worn. During this period, all wearing apparel should hang from the shoulders, should not be too tight and should be adjustable to the gradual enlargement of the figure. The present-day maternity outfits have been developed in accordance with these principles and are to be commended, while too strenuous efforts to conceal the changes in the figure are to be condemned.

The ordinary straight-front corset becomes so ill-fitting during the last three months, that it should be discarded in favor of a simple light weight maternity corset. The mechanical principle involved in its construction is correct and consists in giving snug support to and in exerting upward pressure upon the lower abdomen, where the strain is greatest. They are tight around the hips, but loose over the upper abdomen, where they also help to support the breasts. They should always be fitted by one familiar with the results sought. The cost is not great and is repaid by the added comfort.

Good sense has never endorsed the wearing of French heels, and they should be discarded during pregnancy. At best they afford an insecure footing and conduce to turned ankles and to falls which produce undesirable jarring of the body. Any form of high heel may cause backache by placing undue strain on the back muscles and such strains are more annoying during the later months of pregnancy. Sensible, broad, low-heeled shoes can alone be recommended.

Brassières when not worn tight enough to interfere with the circulation in the breasts are not harmful.

Care of the Breasts.—The breasts themselves need no attention other than support, but the nipples may require considerable preparation to make them capable of withstanding the suckling of the child. A vigorous infant is not gentle in nursing and the skin covering the nipples must be tough and elastic if it is not to be bruised and cracked by its efforts. Most physicians have their own method of treating the nipples and will instruct their patients accordingly. Hardening applications such as compound tincture of benzoin, alcohol and boric acid, or alum are widely employed, but it seems that better results are obtained by the following simple procedure. The nipples and surrounding skin are scrubbed twice daily for periods of three to five minutes with a moderately stiff flesh brush using warm water and castile soap. Following this they are rubbed with lanolin or cocoa butter, which is allowed to remain.

A normal nipple upon stimulation should protrude at least a quarter of an inch beyond the surrounding areola, and failure to do so is usually due to an abnormal retraction. Satisfactory nursing depends largely upon the ability of the infant to take the nipple well back into the mouth, and consequently retracted nipples require prolonged preliminary manipulation to make them serviceable. At the time of the routine scrubbing, each nipple should be grasped between the thumb and fingers and alternately pulled out and allowed to recede. By continuing this for a few minutes twice daily the desired prominence can frequently be attained. This method is quite simple but the attending doctor may recommend another.

The Skin.—The skin glands are unusually active during pregnancy, and daily bathing should be the rule. Tepid shower or tub baths are advised during the earlier months with a cold sponge in the morning if that has been the custom. Prolonged hot baths are enervating and should be avoided. Rubbing with a coarse towel stimulates the superficial blood vessels and helps keep the skin in good condition. In the last month tub baths are usually forbidden, especially in multiparae, because of the possible danger of introducing pathogenic bacteria into the vagina, where they may cause the development of puerperal infection, should labor occur before they have been destroyed by the bactericidal action of the vaginal secretion.

Women familiar with the occurrence of striations on the abdomen frequently express a desire to prevent their formation. It is doubtful whether any external applications are efficacious, but there is no harm in the daily use of cocoa butter or cold cream with light friction. Strenuous massage is useless and may prove harmful.

Pigmentation of the skin is due to some unknown factor and cannot be avoided. Brunettes are more apt to suffer than blondes.

The Teeth.—The tendency for the teeth to decay during pregnancy makes it imperative that special care be taken to reduce the danger to the minimum. About the middle of the period, the patient should visit her dentist, who should remedy all defects. "A clean tooth never decays," but more scrupulous cleanliness is essential during pregnancy than at other times. The conscientious use of brush, paste and dental floss several times daily will prevent any serious damage. Alkaline mouth washes are often recommended, as they not only limit the production of acid, but make the mouth feel cleaner. The popular sentiment against extraction during pregnancy is no argument against the prompt removal of a hopelessly decayed tooth.

Douches.—Vaginal douches of plain or medicated water are not necessary and should be used only when ordered by the physician in charge. Normally the vagina is kept clean by the mechanism already described, but pathological conditions require individual medical supervision. Except in urgent circumstances, and then under special aseptic precautions, douches should not be employed during the four weeks preceding the expected date of delivery, because of the danger of introducing harmful bacteria.

The external genitalia should be kept especially clean by the use of warm water and soap.

Sexual Intercourse.—If agreeable to the patient, moderate sexual indulgence is not contra-indicated during the early months of pregnancy, unless there is a known tendency to abortion. It is usually best to refrain at the times when the menstrual periods would ordinarily be expected, as the uterus is then supposed to be more irritable. Coitus is likewise unwise during the last four weeks, because of the danger of puerperal infection should labor follow within a few days. Our inability to designate in advance the day when labor will begin has already been emphasized, and consequently safety demands that all vaginal manipulations be made only under aseptic precautions.

Preliminary Examination.—A thorough physical examination is invariably necessary during pregnancy, so that the physician will have a knowledge of all the factors which may influence the outcome. The heart and lungs should be carefully examined for the purpose of detecting unsuspected lesions, which might influence the later course of events, and the breasts inspected for abnormalities. Abdominal palpation will reveal the height of the fundus and allow an objective estimate of the probable duration of pregnancy. In the last few months, the fetus can be outlined, when its presentation and position can be determined and the fetal heart can be heard and counted. The pelvis should be carefully measured, so that the possible existence of contraction may not be overlooked. This routine examination should include a vaginal examination to eliminate the possibility of pelvic tumors obstructing the birth canal or the existence of other abnormalities, as well as to permit the digital exploration of the pelvic inlet. The blood pressure is determined, but in the absence of symptoms or of visible defects, the extremities and head are only examined casually. The results of the examination are recorded in a concise obstetrical history, which is preserved for future reference.

In hospital practice this is all done at the first visit, and the subsequent examinations are much less complete, the attention being focused chiefly upon the presentation of the child, the blood pressure and the urine. During the first months the patients should report for observation once a month, from the seventh to the ninth month every two weeks, and, during the last four weeks, every week. A follow-up system is employed to insure the regular return of the women for examination.

Physicians engaged in private practice will have their own routine, but in the end will obtain the same information. The first visit is frequently in the nature of a friendly conversation, and, in the absence of any abnormalities, the preliminary examination may be postponed until six weeks before the expected date, when all necessary information can be obtained at one time and the patient spared the annoyance of repeated examinations. Minor symptoms are reported and simple remedies prescribed over the telephone.

Preparation of the Patient.—The preparation of the patient for such preliminary examinations is subject to considerable variation, but the most logical procedure is for her to empty the bladder and to remove all clothes except the shoes and stockings. With a clean sheet for a covering she can then be taken to the examining table without being exposed, even though it is in the next room. Once in position on the table, the sheet is released from beneath the body, and the chest covered with a small towel. This enables the physician to examine any portion of the body he desires and reduces exposure to a minimum. For the vaginal examination the feet are placed in the leg holders and the sheet draped so as to expose the vulva but to cover the legs and abdomen. If the examination is to be made in the home, the patient should be in bed attired in a nightgown. Pajamas are very inconvenient.

Directions to the Patient.—Institutions, as well as individual doctors doing a large obstetrical practice, often give their patients a card bearing certain instructions. The following is used in the Johns Hopkins Dispensary, and is also available in Italian, Polish and Yiddish translations.

THE JOHNS HOPKINS HOSPITAL

OBSTETRICAL DEPARTMENT

INSTRUCTIONS FOR EXPECTANT MOTHERS

1. A nurse will call at your home to give you further advice a few days after your visit to the Dispensary. Try to be at home when she calls.
2. Come to the Dispensary once a month on the same date.
3. Return at once if you have:
   (1) Pain.
   (2) Bad headache or dizziness.
   (3) Much swelling of the face or legs.
   (4) Chills or fever.
   (5) Soreness of private parts.
   (6) Severe constipation.
   (7) If you don't feel the child move.
4. If you bleed, go to bed, and send to the Hospital for the doctor.
5. Take plenty of out-door exercise, but do not overtire yourself. Avoid heavy work in the last three months.
6. Avoid indigestible food and alcoholic liquors. Drink two quarts of fluid each day (milk, water, soup, tea, coffee, lemonade or seltzer).
7. Avoid sexual intercourse in the last month.
8. Remember that the ideal food for the baby is your own milk, so if you desire to raise a healthy child make every effort to suckle it.
9. If you are to be confined in the Hospital, come to the Broadway entrance as soon as your pains start and bring your card.
10. If you are to be confined at home:
    (1) The nurse will call a month before you expect the baby to see that you have everything ready.
    (2) As soon as your pains are strong and regular, send your card to the Broadway entrance of the Hospital by a man who can carry the Doctor's bags.
    (3) Do not let anyone examine you with the fingers until the Doctor comes. *It is dangerous.*
    (4) After labor you will be visited by the Doctor and nurse as long as necessary.
11. If you desire it a nurse will visit the baby until it is a year old.

Urinary Examination.—The importance of examination of the urine has long been recognized and periodic tests are imperative. From the middle of pregnancy, the urine should be examined every two weeks, particularly for albumin and casts. The specimen should consist of 3 or 4 ounces (100 cubic centimeters) of urine passed on arising in the morning and placed in a clean bottle marked with the patient's name and address. It should be sent to the doctor the same morning, so that he may receive it before decomposition has begun. If a longer time must elapse, as when forwarding by mail, bacterial action may be retarded by the addition of a teaspoonful of chloroform or toluene. In dispensary work the patient voids before going to the examining room and a specimen is thus available for immediate examination. Unusual emphasis is laid upon this detail of supervision because careful urinalysis frequently makes it possible to prevent certain very serious conditions which occasionally arise during pregnancy. The various pregnancy toxemias, chief among which is eclampsia, are frequently first evidenced by the appearance of albuminuria, and the prompt institution of suitable treatment may serve to prevent the disease.

Blood Examination.—The Wassermann reaction is the blood test for syphilis, and many large clinics make it a routine for all obstetrical patients. The necessary specimen is obtained from a vein in the forearm at the first visit. This disease and its relation to child-bearing will be discussed fully in a later chapter.

MINOR AILMENTS OF PREGNANCY

Pregnancy itself may give rise to unusual and unpleasant symptoms which are extremely annoying to the patient, but which are so common as to be considered practically normal accompaniments of the condition. No women suffer from all of them, and on the other hand few women escape them all. In general, the cause is mechanical in nature, but, in some instances, it must be referred to toxic materials which have passed the placental barrier.

Nausea and Vomiting.—This has already been mentioned as one of the probable symptoms of pregnancy, and occurs in one-half to two-thirds of all pregnant women, most of whom look upon it as a natural result of their condition. Dietary control is more efficacious than medicinal treatment. It has been found that eating a few dry crackers before arising will frequently prevent the early "morning sickness." Generally, if this period can be safely passed, the day will be free from annoyance, but if the tendency to "sick stomach" persists, the diet must be carefully regulated and constipation avoided. Perhaps the most beneficial results are obtained by taking small quantities of food five or six times during the day, rather than the usual three meals. Medicines give little relief, but the unpleasant after effects of the vomiting may be largely reduced by the use of Milk of Magnesia as a mouth wash or by the internal administration of a teaspoonful of the same remedy in a small quantity of water. Rarely, the vomiting is so persistent that it prevents the patient from obtaining sufficient nourishment and becomes distinctly abnormal. It is then designated as pernicious vomiting, a condition which will be discussed in the chapter on the toxemias of pregnancy.

Hyperacidity.—Excessive secretion of hydrochloric acid in the stomach is much more frequent during pregnancy than at other times and gives rise to two very annoying symptoms, heart-burn and flatulence. Since they have their origin in the same abnormality of function, it may be supposed that they will respond to the same treatment, and such is the case. In the most logical method of therapy, a liquid fat is used to coat over the openings of the gastric glands and thus decrease their secretory activity. For this purpose a dessertspoonful of olive oil or a small cup of cream is taken a few minutes before the meal and almost invariably gives the desired relief. Even though fat is so efficacious in preventing this malady, it should not be indulged in excessively during the meal, because it definitely slows the digestive process, thus causing a prolonged secretion of acid and a resulting hyperacidity.

If the symptoms are already present, the oil is worse than useless, and curative rather than preventive measures are indicated. Here the rational procedure is to dilute the acid with copious drinks of water and to neutralize it by the administration of an alkali. For this purpose a teaspoonful of sodium bicarbonate (baking soda) dissolved in a quarter glass of water, a tablespoonful of lime water or a teaspoonful of milk of magnesia may be used and repeated if necessary.

Intestinal Flatulence.—Putrefactive bacteria in the intestine will sometimes produce gas by their action upon various food residues and the resulting pressure will make the patient decidedly uncomfortable. This symptom is aggravated by constipation, and the first step in its treatment should be directed to regulating the bowels. The diet should be changed by reducing the starchy foods and sugars, which furnish the food for the millions of organisms. Attempts to change the bacterial flora by the use of buttermilk or bacillus bulgaris tablets are sometimes successful, as these latter organisms multiply so rapidly that they literally starve out the gas-producers, and thus relieve the tendency to flatus formation. Daily use of this remedy is necessary to prevent recurrence of the symptoms. Intestinal antiseptics such as beta-naphthol (dose—0.2 to 0.6 gram; 3 to 10 grains) or phenyl salicylate (salol) (dose—0.5 to 2.0 grams; 7 to 30 grains) are frequently used, but rarely prove efficacious.

Constipation.—If the bowels do not move at least once daily the patient is regarded as constipated, and a large percentage of pregnant women are thus affected. The advantage of cultivating a proper habit and the use of certain articles of food have already been discussed, but if these fail to bring relief medical measures must be employed. Unless there is special need for thorough purgation, only the milder laxatives should be used. A favorite remedy is "senna prunes," which is prepared as follows: Steep an ounce of senna leaves in a quart of boiling water for an hour or two. Strain and discard the leaves. Add a pound of dried prunes to the liquid and allow to simmer until the prunes are thoroughly cooked and the liquid is concentrated to a thin syrup. Sweeten to taste. Eat the prunes and syrup with the evening meal, regulating the amount according to individual needs. An excellent prescription to relieve obstinate constipation is the following:

Fluid extract cascara sagrada	6 drams	24.0 c.c.
Glycerin	1 1/2 oz.	45.0 c.c.
Tincture nux vomica	3 drams	12.0 c.c.
Water, enough to make	6 oz.	180.0 c.c.

Give one teaspoonful (4.0 c.c.) three times daily before or after meals.

Cascara sagrada pills (dose—0.3 to 0.6 gram; 5 to 10 grains); Aloin, belladonna and strychnin pills (dose—1 to 2 pills); Lady Webster pills (dose 1 to 2 pills); Compound licorice powder (dose—4.0 to 8.0 grams; 1 to 2 drams); or phenolphthalein (dose—0.2 to 0.3 gram; 3 to 5 grains) may be used occasionally with good results, but are not satisfactory for continued administration. Mineral oil in repeated small doses is widely recommended because of its mild action and the absence of aggravated constipation as a sequel to its prolonged use. The objection to the employment of castor oil and the saline purgatives is their tendency to provoke uterine contractions. Even though this danger is remote, it should receive some consideration, particularly when equally satisfactory results can be obtained with the milder drugs. There is no objection to the occasional use of a simple enema but its repeated employment leads to loss of bowel tone and aggravates the condition it is intended to relieve.

Loss of Appetite.—Pregnant women usually have a good appetite, but occasionally the dislike for food interferes with proper nourishment of the body, and some measures must be inaugurated to insure a sufficient intake. Exercise in the open air will frequently prove a sufficient stimulus, but in other cases a tonic is necessary. Tincture of nux vomica or tincture of gentian singly or in combination are quite generally employed. The following prescription can be recommended:

Compound tincture of gentian	1 $^1/_2$ oz.	45.0 c.c
Tincture of nux vomica	2 drams	8.0 c.c.
Sodium bicarbonate	2 drams	8.0 grams
Water, enough to make	6 oz.	180.0 c.c.

M.et Sig. Two teaspoonfuls (8.0 c.c.) three times daily before meals.

Pressure Symptoms.—The growing uterus increases the intra-abdominal pressure and may produce certain symptoms, notably edema, varicose veins and hemorrhoids. None of these are serious and rarely can much be done for their relief, but they disappear promptly following delivery.

Edema.—Swelling of the feet and ankles is common in late pregnancy, when the weight of the uterus partially obstructs the return of blood from the lower extremities. The fact that edema may likewise be a symptom of kidney disease is always to be borne in mind and the mechanical origin of the swelling determined by exclusion of this more serious possibility. If urinalysis and blood pressure readings show no abnormality, the symptom can safely be attributed to pressure. On the other hand, even slight evidence of renal insufficiency is reason enough for energetic therapeutic measures. Edema of the vulva and lower abdominal wall are rarely due to pressure alone. Marked swelling of the face may be of serious import, and should always lead to consultation with the physician.

The slight puffiness of the feet noted so frequently late in pregnancy is due in large part to the erect position of the patient and is usually absent or much less marked early in the morning. The only available treatment is rest in the reclining posture or in a chair with the feet elevated. When the condition is extreme, rest in bed is indicated until the swelling has subsided. Medical measures are of no avail.

Varicose Veins.—A varicose vein is one which has become abnormally swollen and tortuous. The condition is most common in the superficial vessels on the inside of the legs and thighs, but may occur in other localities. The causative factor is increased venous pressure brought about by long continued standing or by other obstruction to the return flow of blood in the presence of constitutionally weak vessel walls. During pregnancy the second factor is in the foreground because of the weight of the enlarged uterus pressing upon the veins from the lower extremities. Generally, varicose veins do not develop during the first pregnancy, but appear later in the child-bearing career as the result of the repeated strain put upon the vessel walls. The right leg is more commonly affected than the left, because the right common iliac vein is crossed by its accompanying artery, and is, therefore, more readily compressed.

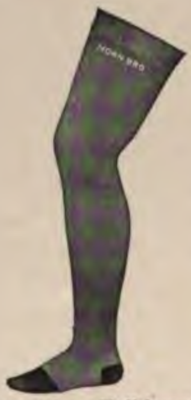


FIG. 52. — Full-length elastic stocking worn for relief of varicose veins.

Treatment is directed at relieving the pressure or supporting the dilated veins mechanically. The former can be partially accomplished by rest in bed or by sitting with the feet elevated, and will give considerable temporary relief while tending to limit the process. Mechanical support may be obtained by the use of a thick muslin or flannel bandage applied from the foot to the middle of the thigh or by an elastic stocking covering the same region. If properly applied, the former is perhaps better, but a properly fitting stocking has the great advantage that it can be put on or removed without assistance. In either event, it should be removed at night and reapplied before arising in the morning, except in very severe cases, where a light bandage should also be worn during sleep. Rupture of the dilated veins rarely occurs, but when it does, alarming hemorrhage may result. The bleeding is, of course, venous in origin and therefore can be temporarily controlled by the application of firm pressure over the bleeding points, although ligation may be necessary for permanent relief. The veins become greatly reduced in size following delivery and usually do not require further treatment. Varicose ulcers are infrequent, but, when present, are treated as in the non-pregnant condition.

Hemorrhoids.—Varicose conditions of the veins of the lower rectum and anus give rise to hemorrhoids or piles. This condition is common during pregnancy and occasionally proves very annoying. Constipation is a frequent accompaniment and must be relieved before any treatment will be efficacious. If the hemorrhoids protrude after defecation or other straining movements they should be replaced by the patient as soon as possible. For this purpose, a folded piece of toilet paper is much superior to the bare fingers. Cold applications frequently give marked relief, and the patient should make it a practice to bathe the parts with cold water whenever she uses the toilet. Witch hazel compresses or gall and opium ointment are useful when the pain is severe. Operation should not be resorted to during pregnancy because the condition ordinarily becomes less annoying following delivery, and surgical intervention gives little promise of permanent relief.

Leg Cramps.—As a child's head descends into the pelvis during the last weeks of pregnancy, it may press upon one of the sciatic nerves and produce pain, either localized in the lower part of the back or radiating down the leg. The side affected will depend upon the position of the child. Since the head usually occupies the right oblique diameter of the pelvis, these cramplike pains are commonly confined to the right leg. Change of position sometimes gives relief, but the pain is rarely so severe as to require treatment and always disappears as soon as the child is born.

Shortness of Breath.—Toward the end of gestation, the upward pressure of the uterus may interfere with respiration and produce a mild dyspnœa, which is aggravated by the recumbent position. Elevating the head and shoulders will usually permit the patient to sleep comfortably. In normal pregnancy, the condition is rarely of much moment, but abnormal distention due to twins or hydramnios may necessitate radical procedures.

Pruritis Vulvae.—Itching and burning of the vulval region frequently accompanies the increased vaginal secretion. This condition can usually be relieved by the application of a bland oil or ointment to the affected areas supplemented by frequent sprinklings with talcum powder. Pronounced leucorrhea needs medical attention, because it may be the sign of a serious bacterial infection. Douches should not be used except by order of the attending physician.

Headaches.—Headache is such a frequent symptom of slight derangements in various parts of the body that it is certain to occur during the course of most pregnancies. In itself, it is not serious, but, since it may be a symptom of renal insufficiency, it demands careful attention. Particularly in the last three months of pregnancy, headache should always be regarded as a danger signal; consequently, the indiscriminate use of aspirin or other popular remedies is to be condemned. A particularly severe headache or one which persists for more than six hours should be reported to the physician immediately. Examination of the urine and determination of the blood pressure will serve to rule out renal insufficiency or other toxemias of pregnancy, while a physical examination will usually eliminate other serious diseases. This advice should never be disregarded, particularly if the symptom is associated with visual disturbances.

Insomnia.—Various conditions due to pregnancy itself may be sufficient to produce insomnia. Mental uncertainties, abdominal pressure and fetal movements are the most frequent causal factors, and can rarely be combated directly. An environment suitable for sleep should be assured, and, if this fails, recourse may be had to warm baths or a glass of warm milk before retiring. Hypnotics should not be used except upon prescription by a physician. The habit of sleeplessness is mental in origin and must be carefully treated by suggestion and proper discipline.

CHAPTER VI

THE PHYSIOLOGY OF LABOR

Definition.—Labor may be defined as a succession of painful contractions of the uterus resulting in the expulsion of the mature or nearly mature product of conception (child, placenta and membranes) from the uterine cavity into the outer world. These painful contractions are spoken of as "labor pains." The term "labor" itself expresses the expenditure of physical energy on the part of the mother. The process is usually continuous and persists from the onset of regular pains until the completion of the birth.

Normal Labor.—Despite the general physiological character of the birth process, the term "normal labor" is not good usage, because the distinction between normal and abnormal is too indefinite. The expression "spontaneous labor" indicates that the process has been inaugurated and completed by the efforts of nature alone, and its use is much to be preferred; although, even here, an unusual presentation of the fetus or an unusually prolonged labor may introduce factors which are abnormal, without necessitating interference by the obstetrician. By introducing certain qualifications, a "normal labor" may be defined as one occurring at or near term with the child presenting by the vertex, and terminating spontaneously within twenty-four hours.

"Premature labor" includes those occurring after the twenty-eighth week of pregnancy, that is, after the period of viability of the child has been reached, but before full development has been attained. Previously to this period, the general term *miscarriage* is employed, although most physicians designate the expulsion of the ovum during the first four months as an *abortion*. As the latter expression suggests a criminal proceeding to most laymen, we may as well conform to their terminology and apply the common term *"miscarriage"* to all cases in which the uterus is emptied before the end of the seventh lunar month.

Stages of Labor.—The birth process naturally divides itself into three stages, each with its separate purpose. The "first stage" or "period of dilatation" begins with the first regular painful contraction and continues until the cervix has become fully dilated; the "second stage" or "period of expulsion" extends from this time to the complete extrusion of the child; and the "third stage" or "placental period" from that event until the expulsion of the placenta and membranes.

Duration of Labor.—As ordinarily computed, the duration of labor is calculated from the time of the first labor pain to the completion of the third stage, and is usually estimated at about eighteen hours for a first child and twelve hours for succeeding children. In the labor of average duration, the period of acute suffering is generally not longer than four hours. While such figures represent actual averages from many thousands of cases, it is probable that a given case will be completed in a shorter period, and experience teaches that primiparous labors are most likely to end in twelve to fifteen hours and multiparous labors in six to nine hours, although in either class of patients the birth process may exceptionally terminate within the first hour or may drag along for three or four days. The averages usually given for the various stages are as follows:

	First stage		Second stage		Third stage		Total in hours	
	Hours	Minutes	Hours	Minutes	Hours	Minutes	Hours	Minutes
Primiparae....	16	...	1	45	..	15	18	...
Multiparae. ..	11	...	..	45	..	15	12	...

In elderly primiparae (thirty-five years or older) there is a tendency for labor to be prolonged, the slower progress being attributed to the greater rigidity of the soft parts of the birth canal.

Labor is not said to be prolonged unless it lasts for more than thirty hours.

Time of Delivery.—The prevalent idea that delivery usually occurs at night is erroneous, as is shown by the records from large series of cases. In the two periods, 6 A.M. to 6 P.M. and 6 P.M. to 6 A.M., the number of births is practically equal, only five per cent more children being born in the latter period. Undoubtedly, the popular conception is due to the fact that most labors last twelve hours or more, and, consequently, either begin or end during the night, so that the process is associated with the hours of darkness.

Cause of the Onset of Labor.—Science has not yet revealed the nature of the stimulus which inaugurates the process of birth. In all probability, it is a material elaborated by the product of conception and passed to the uterine muscle by the blood stream. Its nature is unknown, nor can it be explained why it usually stimulates the uterus to contract about two hundred and eighty days after the last menstrual period. Extract of the posterior lobe of the hypophysis, if given in repeated small doses toward the end of pregnancy, will sometimes inaugurate labor, and, occasionally, the same result follows the administration of castor oil and quinine.

The Physiology of Labor Pains.—Every ten or fifteen minutes throughout pregnancy, the uterus undergoes painless contractions of the Braxton-Hicks variety, and in the latter months these become more frequent, but have no tendency to bring about dilatation of the cervix or evacuation of the uterus. Finally, at the time of labor, their character changes; they increase in strength, become painful and produce the necessary dilatation of the pelvic tissues. The striking difference between true labor pains and the contractions of pregnancy is that the former are subjectively appreciated by the patient as pain.

Both types of contraction produce characteristic changes in the uterus. The organ becomes hard and boardlike when palpated through the abdominal wall, and the examiner is no longer able to feel the fetal small parts. At the same time, the uterus straightens into a more cylindrical form, and, if the patient is on her back, the abdominal wall is pushed forward and becomes more prominent. During the pregnancy contractions, the patient may be conscious of these changes, even though there is no pain.

Both types of contraction are independent of the will and cannot be produced or stopped voluntarily, but may be influenced somewhat by emotional states. Thus, fright or grief may cause labor to begin, and during labor the pains may cease for a time after the arrival of the physician. Certain drugs, likewise, influence the intensity of the contractions and are utilized in obstetrical work for this purpose. For example, pituitary extract produces more frequent and more severe contractions, whereas morphine usually decreases the frequency and intensity.

Force of the Uterine Contractions.—The pressure exerted by the uterine contractions has been variously estimated, but in general it is considered that the early pains exert a force of less than ten pounds, whereas the last expulsive contractions are three to five times as strong.

Toward the end of the second stage, efforts to restrain the advance of the head call for the expenditure of very considerable energy on the part of the attendant. It has been shown that each contraction gradually increases to a maximum and then promptly decreases in intensity. The very first part of the contraction can be appreciated by the examiner before the patient is aware of it.

First Stage Pains.—The first stage usually begins with twinges of pain in the back or lower abdomen, which recur at fifteen to thirty minute intervals. Gradually they increase in frequency and intensity, until they are five to ten minutes apart and cause progressively more pain. The pains may remain localized in the back, but more frequently radiate around to the front and down the thighs. The interval between the contractions is free from pain, and the patient is quite comfortable, although dreading the next pain. The abdominal muscles are not called into action and normally no straining efforts are made. Many multiparae attempt to hasten this stage of dilatation by voluntary abdominal pressure, but the effort is useless. Moreover, the resulting fatigue may prevent the completion of the stage of expulsion as rapidly as otherwise. During this period the patient is not conscious of any changes promising release from suffering, and consequently toward its end she may become nervous and noisy. The task of the attendant is to assure her that Nature is slowly but surely taking her course and that the passages are becoming dilated in order to permit the passage of the child.

Second Stage Pains.—The second stage, or expulsive period, is undoubtedly the time of greatest suffering, but the patient is fortified by the feeling that progress is being made, and that the physician can safely ease the pains, at least to some extent, by the administration of an anesthetic, without danger of retarding the birth process. Abdominal straining efforts are now the rule, and the patient braces herself and bears down with each contraction. An expiratory grunt at the acme of each pain is quite characteristic and frequently the doctor can recognize the advent of the second stage by such sounds. During the stage of expulsion, "bearing down" with the abdominal muscles is entirely reflex in character, and, especially after the head of the child has reached the pelvic floor, the patient cannot resist the natural tendency to hasten its expulsion.

Third Stage Pains.—The last pains have been so close together as to seem almost continuous, but after the child has been expelled there is a real freedom from pain. Five or ten minutes later, the uterus again begins to contract in an effort to separate the placenta, and continues to do so at intervals, until this has been attained. Usually a few contractions are sufficient, and they seem only slightly painful when compared with those of the previous second stage.

CLINICAL COURSE OF LABOR

First Stage.—During the last few weeks of pregnancy in primigravidae, the head descends into the pelvic cavity until it is practically resting on the pelvic floor. The cervical canal has, likewise, become somewhat shortened, and the external os is sufficiently patulous to admit the finger tip. The first pains of labor cause a small pouch of membranes filed with amniotic fluid to be pushed out before the head. This constitutes the "bag of waters," which acts as a soft dilating wedge and exerts uniform pressure when the intermittent contractions put the uterine contents under increased tension. At first this force is employed in obliterating the remaining cervical canal until it is represented only by the small external os. The succeeding pains then serve to dilate this os until it is sufficiently large to permit the passage of the head—nine to ten centimeters in diameter. At this point the "bag of waters," having served its purpose, usually ruptures, as is indicated by the expulsion of a small amount of fluid from the vagina. The first stage has now ended and the passage is prepared, so that all subsequent contractions can be devoted to expelling the child.

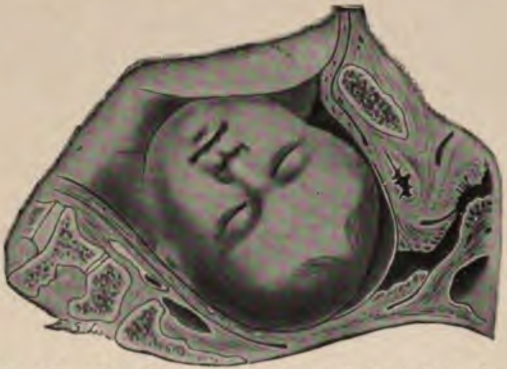
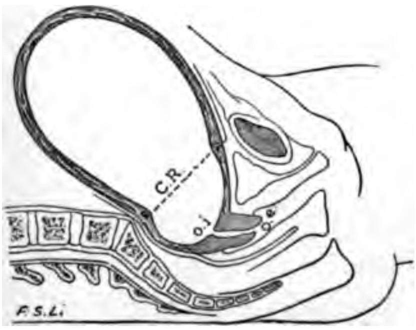


Fig. 53.—Conditions obtaining early in labor; the "bag of waters" beginning to obliterate the cervical canal; the head well down in the pelvis. (Williams.)

At the end of pregnancy the uterus appears as a closed muscular sac with thin tough walls rarely exceeding five millimeters ($^1/_5$ inch) in thickness, but the process of obliteration of the cervical canal and dilatation of the external os is accompanied by the formation of two distinct segments in the uterus itself. The greater part of the body of the uterus participates in the contractions of that organ and forms the upper contractile segment, while the cervix and a narrow ring of tissue just above it are passive throughout and constitute the *lower uterine segment.* The line of demarcation between the two is *Braun's or Bandl's contraction ring,* which is noted as an abrupt thickening of the uterine wall just above the internal os. As labor progresses, the walls of the upper segment become thicker and those of the lower segment thinner. In certain individuals with thin abdominal walls Bandl's ring is palpable, while in obstructed labor it can be felt to rise gradually toward the umbilicus. Under such circumstances the lower segment becomes greatly elongated and so thinned out that in extreme cases it may rupture and the fetus be expelled into the peritoneal cavity.



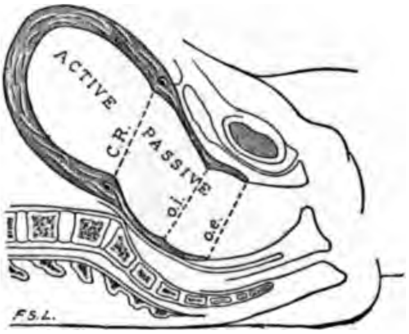


FIG. 54. FIG. 55.

FIG. 54.—Diagram of the birth canal at the end of pregnancy. (Williams.) (*o.e.*, external os; *o.i.*, internal os; *C.R.*, Braun's contraction ring.)

FIG. 55.—Diagram of birth canal during the second stage of labor, showing the further development of the lower uterine segment. (Williams.) (*o.e.*, external os; *o.i.*, internal os; *C.R.*, Braun's contraction ring.)

Dilatation of the external os is frequently accompanied by small lacerations of the cervical mucosa, from which there is slight bleeding, in which event the mucous vaginal secretion becomes blood-tinged and constitutes the "*show*." In certain cases this phenomenon is useful diagnostically as indicating that labor has begun. In other cases it is not visible at any time during the course of labor. When partial cervical dilatation has occurred before painful contractions commence, the "show" may be the first evidence of labor. This normal sign must not be confused with actual hemorrhage, which, even if only relatively slight, points to some abnormal condition of the placenta.

Premature rupture of the membranes occurs in about one quarter of all cases, and occasionally happens before the onset of labor. In such circumstances, painful contractions will usually begin within a few hours, but may sometimes be delayed for several days. Usually, premature rupture occurs only after labor has been in progress for some time. When the "waters break" before complete cervical dilatation is accomplished and considerable amniotic fluid drains away, a "dry labor" results. If this occurs before the cervix is half dilated labor is frequently prolonged, for the reason that the normal hydrostatic wedge is lacking and must be replaced by the head or breech of the fetus, which is a much less efficient dilator. After half dilatation has been secured the probability of delay is much reduced. Occasionally, a rubber bag filled with sterile fluid may be introduced by the physician between the presenting part and the cervix to replace the ruptured "bag of waters," and thus shorten what might otherwise be a prolonged dry labor.

In multiparous patients the first stage is generally shorter than in primiparae, due to the fact that after the cervical canal has been obliterated the external os offers but little resistance and dilates very readily.

To recapitulate, the onset of labor may be heralded by any of the following signs:

1. Definite intermittent painful uterine contractions.
2. The rupture of the "bag of waters."
3. The appearance of a "show."

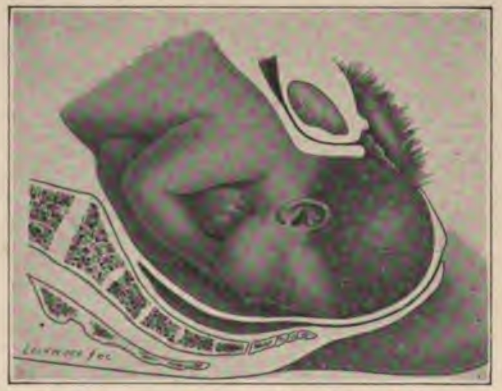


FIG. 56.—Diagram showing distention of the vagina and thinning out of the perineum by the advancing head. (Williams.)

Second Stage.—The child descends little or not at all during the first stage, but upon its completion the entire energy of the uterine contractions is directed toward the expulsion of the child, and its head moves gradually toward the vulva. Descent is explained, partly by the force of the uterine contractions, assisted by the abdominal muscles, and partly by the fact that the child straightens out, so that while its upper portion is firmly stemmed against the fundus its presenting part is slowly pushed down.

Expulsive pains appear soon after the beginning of the second stage and continue until delivery is accomplished. Most frequently the actual pain is located over the sacral region and is associated with cramps in the legs due to pressure upon the nerves supplying them. Firm rubbing of the back and occasional straightening of the legs will give some relief.

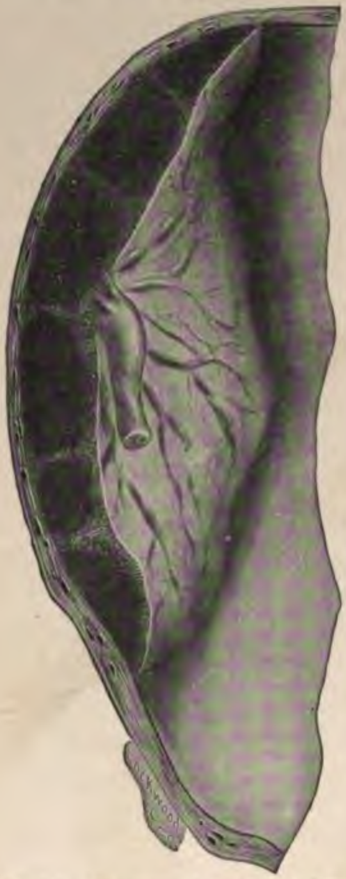


FIG. 57.—Diagram showing relation of placenta to the uterine wall in the latter part of pregnancy. (Williams.)

The pelvic congestion obtaining throughout the latter part of pregnancy has made the tissues of the perineum more elastic than normal and the advancing head slowly overcomes this last resistance. The perineal body is pushed outward and upward, and becomes so thinned that its anterior margin is scarcely thicker than heavy paper. The outlet is gradually stretched until the greatest diameter of the head has passed, after which the birth of the body is relatively simple.

Third Stage.—As the child is expelled, the uterus contracts and finally closes down upon the placenta. After a few minutes, rhythmic contractions again make their appearance in an attempt to expel this last part of the product of conception. Before the birth of the child, the placenta is about two centimeters ($^{4}/_{5}$ of an inch) thick and is spread out over a relatively large area of the inner surface of the uterus; but after birth, the area of attachment is greatly diminished by reason of the contraction of the uterus and minute breaks occur in the spongy layer of the decidua. Blood flows into these crevices from the torn maternal vessels and the increasing hematoma rapidly peels the placenta from the uterine wall by following the line of least resistance. Normally, within a few minutes the afterbirth is completely separated and the next uterine contraction pushes it into the lower segment and vagina. The empty uterus is now able to contract and retract without interference, and efficiently controls the loss of blood from the torn vessels, but there is no satisfactory mechanism for the further progress of the placenta, and if left entirely alone it will usually be some hours before it is completely extruded. At this time slight pressure upon the fundus in the direction of the pelvic axis is sufficient to complete its delivery.

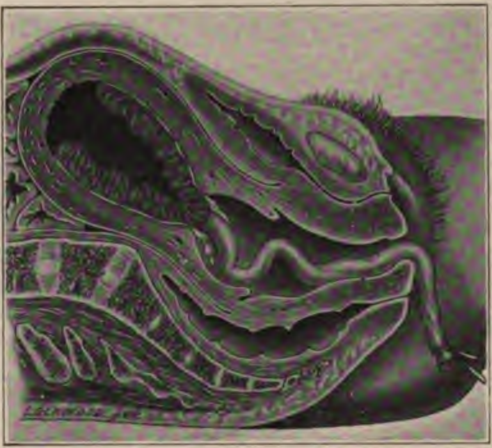


FIG. 58.—Diagram to show separation of placenta by Schultze's mechanism. (Williams.)

Two mechanisms of placental separation have been described and both are frequently observed. In the first, or *Schultze's mechanism,* the separation occurs near the center of the organ and the developing hematoma pushes the body of the placenta out through the membranes, so that the fetal surface with the attached cord first appears at the vulva. There is usually no bleeding until after the organ is expelled. In the *Duncan mechanism,* on the other hand, the separation begins at the margin of the placenta and the spreading hematoma pushes

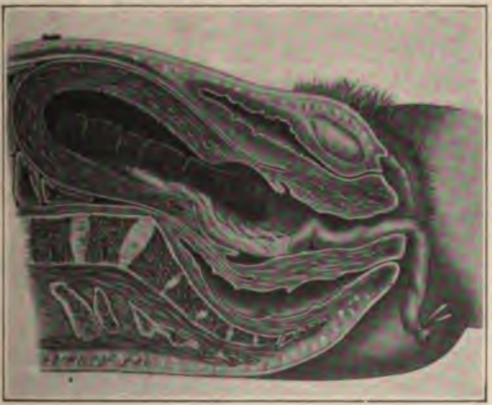


FIG. 59.—Diagram illustrating separation of placenta by Duncan's mechanism. (Williams.)

the tissues aside in such a way that the fetal surface is rolled in, and an edge of the maternal surface appears at the outlet. Slight bleeding generally occurs throughout the entire duration of this mode of separation.

At the completion of the second stage the uterus follows the child in its descent and finally clamps down tightly about the placenta. It is then palpable as a firm hard tumor in the mid-line below the umbilicus. Following the spontaneous separation of the placenta from its area of attachment, the fundus rises, and is felt three to seven centimeters (one to three inches) higher than previously, above the umbilicus. Below the firmly contracted body of the uterus, a soft mass can then be seen or felt just above the pubis, and represents the lower uterine segment, which has been distended by the detached placenta. When the latter comes to occupy this new position, the umbilical cord often protrudes from the vulva several inches further than previously. The rise of the fundus and the increase in the visible portion of the cord are utilized practically as signs of placental separation, and indicate that the structure is ready to be expressed. Following completion of the third stage, the uterus remains as a firm hard mass with its fundus at or just below the level of the umbilicus, its height being influenced greatly by the degree of distention of the bladder and lower bowel.

Bleeding has already been mentioned as a usual accompaniment of the third stage, and an average of 350 cubic centimeters (12 ounces) of blood is lost at this time. Very rarely so little blood is lost that it cannot be measured, while, occasionally, the amount is so great that the patient's life is endangered. A loss of between 100 and 300 cubic centimeters (3 to 10 ounces) is the most common, but unless it exceeds 600 cubic centimeters (20 ounces), it is not considered pathological. The normal bleeding produces no symptoms and needs no treatment, but actual hemorrhage is very serious and demands prompt control, and will be considered in detail in a later chapter.

CHAPTER VII

THE MECHANISM OF LABOR

Definitions and Nomenclature.—Labor is primarily a mechanical process, the result of three separate factors: the size and shape of the fetus (the passenger); the configuration of the pelvic cavity and the pelvic floor (the passage); and the force of the uterine and abdominal muscular contractions (the motive force). Supposing that all of these factors are normal, the actual mechanism of the descent of the passenger through the passage depends largely upon the position of the former in the uterus, and we must understand something of this before proceeding.

Obstetricians are agreed that the fetus must lie in one of a limited number of possible positions, and for convenience and accuracy of statement have developed the following definitions and nomenclature.

Attitude or habitus is the posture of the fetus in the uterus. Generally, the back is somewhat convex, the head partially flexed on the chest, the arms and forearms flexed and crossed over the thorax, and the thighs flexed on the abdomen with the legs partially extended and crossed. The result is an ovoid mass, which conforms to the shape of the uterine cavity. The necessity for this accommodation is probably the cause for the characteristic posture, which can be only temporarily disturbed by movements of the fetus.

Presentation refers to the relation between the long axis (the vertebral column) of the fetus to that of the mother. In the longitudinal presentations both axes correspond, whereas in transverse and oblique presentations they are at variance.

Presenting part is the term applied to that portion of the fetus, which first enters the superior strait. In longitudinal presentations, the presenting part may be either the head or the breech (cephalic or breech presentations), while, in transverse presentations, it is the shoulder. Ordinarily, the presenting part continues to be the lowermost portion of the fetus, and so is the first portion to emerge from the vulva.

In cephalic presentations the actual presenting part depends upon the degree of flexion of the head on the trunk. When this is complete so that the chin rests upon the chest, we speak of a *vertex presentation* (Fig. 60), but when the head is extended so that the occiput approaches the back, we have a *face presentation* (Fig. 61). Rarely, intermediate positions are assumed and result in *brow* or *sincipital presentations.*

Likewise, the relative position of the legs and feet in breech presentations introduces several variations. Usually the thighs are flexed against the abdomen and the legs upon the thighs, so that the child assumes a somewhat "squatting" position—*complete breech;* less frequently, the thighs are flexed upon the abdomen and the legs extended toward the head—*frank breech presentation,* and, occasionally, one or both feet or knees may prolapse and thus give *incomplete* or *complete foot or knee presentations.*

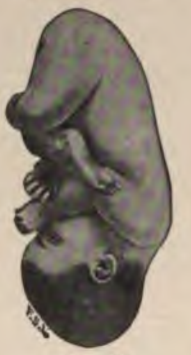


FIG. 60.

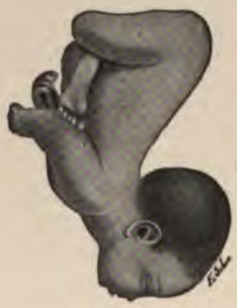


FIG. 61.

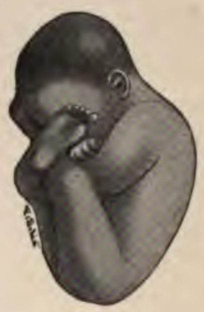


FIG. 62.

FIG. 60.—Characteristic attitude of fetus in utero—vertex presentation. (Williams.)
FIG. 61.—Face presentation—the head extended. (Williams.)
FIG. 62.—Frank breech presentation. (Williams.)

When the long axis of the fetus crosses the long axis of the mother at approximately a right angle, we have a *transverse presentation,* with one or the other shoulder as the presenting part. Occasionally, during pregnancy, an *oblique presentation* may occur, but it has little significance, merely representing a transitional stage, which is eventually converted into a longitudinal or transverse presentation.

Position is the term employed to indicate the relation between an arbitrarily chosen point on the presenting part to the right or left side of the mother. This point is, for the vertex—the occipital bone; for the face—the chin; for the breech—the secrum; and for the shoulder—the acromion process.

Variety.—By this term is meant the relation of this chosen point to the *anterior, transverse* or *posterior* section of the right or left half of the maternal pelvis.

Nomenclature.—In spite of repeated attempts to simplify and standardize the nomenclature, many different systems are still employed. That most generally used in this country and France names in order the position, the presentation and the variety. The following table gives this classification in detail:

NOMENCLATURE OF PRESENTATION

VERTEX PRESENTATIONS

Position	Presentation	Variety	Abbreviation
Left	Occipital	Anterior	L.O.A.
"	"	Transverse	L.O.T.
"	"	Posterior	L.O.P.
Right	"	Anterior	R.O.A.
"	"	Transverse	R.O.T.
"	"	Posterior	R.O.P.

FACE PRESENTATIONS

Position	Presentation	Variety	Abbreviation
Left	Mental	Anterior	L.M.A.
"	"	Transverse	L.M.T.
"	"	Posterior	L.M.P.
Right	"	Anterior	R.M.A.
"	"	Transverse	R.M.T.
"	"	Posterior	R.M.P.

BREECH PRESENTATIONS

Position	Presentation	Variety	Abbreviation
Left	Sacral	Anterior	L.S.A.
"	"	Transverse	L.S.T.
"	"	Posterior	L.S.P.
Right	"	Anterior	R.S.A.
"	"	Transverse	R.S.T.
"	"	Posterior	R.S.P.

TRANSVERSE PRESENTATIONS

Position	Presentation	Position of back	Abbreviation
Left	Acromion	Dorsum anterior	L.A.D.A.
"	"	" posterior	L.A.D.P.
Right	"	" anterior	R.A.D.A.
"	"	" posterior	R.A.D.P.

Frequency of Different Presentations.—Over ninety-five per cent of all children present by the vertex, and the relative frequency of the various presentations is given below. Such figures represent averages obtained from series of many thousands of cases at or near term, but in the earlier months of pregnancy the proportion of breech and transverse presentations is considerably larger.

Longitudinal presentations			99.5%
Cephalic presentations		96.0%	
Vertex presentations	95.4%		
Face presentations	0.5%		
Brow and sincipital presentations	0.1%		
Breech presentations		3.5%	
Transverse presentations			0.5%
			100.0%

Under favorable conditions all longitudinal presentations tend toward spontaneous delivery, but such an outcome is impossible in transverse presentations, which should be regarded as abnormal.

Cause of Predominance of Cephalic Presentations.—The reason for the great predominance of cephalic presentations is not altogether clear, but in all probability the greater density of the head plays a leading rôle. With the fetus suspended in the amniotic fluid the force of gravity must come into play, and consequently the heavier head will naturally seek the lower level near the pelvic inlet. The occurrence of the other presentations in perfectly normal pregnancies, however, demands another explanation, which is offered by the accommodation theory. The proponents of this hypothesis insist that the fetal ovoid mass tends to accommodate itself within the ovoid cavity of the uterus, and that the position of the fetus is determined by the relation existing between these two factors.

Diagnosis of Presentation and Position of the Fetus.—The probable course of labor depends largely upon the presentation of the child and this should always be determined prior to the onset of labor, so that the patient may be assured that everything is normal, or so that the physician may be forewarned against a possible operative delivery. Abdominal palpation usually suffices to establish the diagnosis, and the four maneuvers described below have been developed to that end, it being understood that the patient is in bed with the abdomen bared.

Method of Abdominal Palpation.—*Maneuver 1.*—The height of the fundus is determined by its relation to the xyphoid process of the sternum and the upper pole of the fetus is differentiated. The head can be recognized as a hard, round, ballotable mass, while the breech is irregular and softer and not infrequently changes its shape because of fetal movements.

Maneuver 2.—The hands palpate both sides of the uterus through the abdominal wall in an effort to locate on one side the hard, smooth plane, which represents the back of the child, and on the opposite side the irregular and nodular masses formed by the fetal small parts (arms, legs, hands and feet). If the back is situated anteriorly or transversely it is readily felt, but, when palpation reveals only small parts over the front, the back must be situated out of reach posteriorly.

Maneuver 3.—The hand grasps the lower part of the abdomen, just over the symphysis and attempts to distinguish the presenting part; the head and breech are differentiated as before. If the presenting part is *engaged* in the pelvic inlet, it is fixed, but otherwise it can be freely moved in the amniotic fluid.

Maneuver 4.—If the head presents, the tips of the fingers of the two hands are pushed perpendicularly to the plane of the superior strait along the sides of the uterus until, on one side or the other, a resistant mass is encountered—the *cephalic prominence.* This is important in determining the degree to which the head is flexed. If flexion is complete, the cephalic prominence is on the same side with the child's small parts, but if extremely extended, as in face presentations, it is on the side of the back. Until the head has descended well down into the pelvis, partial flexion is the rule, and a slight prominence can be detected on both sides, being generally higher on the side opposite the back.

Vaginal Examination.—In certain patients the abdominal wall may be so thick or irritable or the uterus so tightly distended with fluid, that abdominal palpation is unsatisfactory. Under such circumstances, vaginal examination must be resorted to in order to establish the diagnosis by differentiating and locating the various characteristic features of the presenting part. To give satisfactory results, the cervix must be sufficiently dilated to admit at least one finger easily. For this reason the method is generally not applicable during pregnancy. With the finger or fingers introduced through the cervix, after the usual aseptic precautions, the presenting part is carefully palpated. The hard, round vertex is easily distinguished from the face, breech or shoulder, and in suitable cases the position and variety can be determined. The various vertex presentations are differentiated by the relation of the various sutures and fontanelles, the face presentations by the location of the chin, and the breech and transverse presentations by the position of the sacrum and shoulder respectively. Because of the slight dilatation of the cervix early in labor, the method does not give accurate results, and toward the end of labor the presence of a *caput succedaneum* may obscure the relations. The latter is a tumor resulting from the effusion of serum beneath the skin over that portion of the presenting part, which is protruding through the external os, and is due to variations in pressure there and elsewhere in the uterus.

When the recto-vaginal septum is thin and the presenting part sufficiently low, equally good results can be obtained by rectal examination, which possesses the great advantage of requiring disinfection neither of the hands of the physician nor of the external genitalia of the patient.

Auscultation of the Fetal Heart.—During the last months of pregnancy the fetal heart sounds can usually be heard over a wide area of the mother's abdomen, but generally are loudest over the portion corresponding to the upper part of the back of the child. In vertex presentations with the occiput anterior, the point of maximum intensity is on the right or left side midway between the umbilicus and the anterior superior spine of the ilium, according as one has to deal with a right or left position, while in breech presentations it is heard in the same vertical line but three or four inches higher. When the back is posterior, the sounds may be audible in the corresponding flank or on the opposite side of the abdomen over the small parts. Generally the position of the area of greatest intensity serves to confirm the results of palpation or of vaginal touch. In twin pregnancies there are frequently two areas of increased intensity, and if the rates in each vary ten beats or more per minute, a diagnosis of the presence of two fetuses may safely be made. The various accessory sounds previously described are occasionally heard.

THE MECHANISM OF LABOR

The shape of the pelvic cavity is so irregular, and the fetal head relatively so large, that the latter cannot pass through the former in any position, and consequently, it must undergo a gradual adaptation to the most available diameters of the former. In order successfully to pass through the true pelvis by the path of least resistance, it is essential that the fetal head and body go through certain definite movements, and the sum of these movements constitutes the mechanism of labor. In studying this process, it should constantly be remembered that, while each individual movement is described separately, no movement occurs by itself and that several of them are taking place at the same time.

Engagement.—This term is applied to the mechanism by which the presenting part enters the superior strait. In primiparae, this normally occurs during the last few weeks of pregnancy, so that the onset of labor finds the most dependent part well down in the pelvis, whereas in multiparae, engagement generally occurs only after labor has set in. The different behavior in the two classes of patients is probably attributable to the greater compression of the uterine contents produced by the better tone of the abdominal and uterine muscles in the former.

Descent.—The gradual movement of the child through the birth canal is of prime importance, not only in itself, but because all of the other movements are associated with it, and it should be recalled that it cannot occur, to any effective extent, until after the cervix has become fully dilated, in other words, until the second stage of labor. Four forces are responsible for the gradual downward movement of the presenting part: (1) intra-uterine pressure due to the labor contractions; (2) direct pressure of the fundus upon the breech; (3) contraction of the abdominal muscles; and (4) extension and straightening of the child's body.

Internal Rotation.—The turning of the presenting part in such a way that its chosen point moves from the position in which it originally entered the pelvis, toward the symphysis pubis or the hollow of the sacrum, is an essential and necessary feature of the mechanism of labor. The rationale of the movement is more easily understood when occipital or vertex presentations are considered.

The size and shape of plane of the superior strait are such that a fetal head of average size can only enter it in one of the oblique diameters

(L.O.A., R.O.P., R.O.A. or L.O.P.). On the other hand, the configuration of the outlet as detemined principally by the form of the vaginal slit, will only permit the passage of the head when it occupies its antero-posterior diameter (O.A. and O.P.). Consequently, in the course of its descent from the inlet to the outlet, the occiput must rotate to the symphysis pubis, thereby passing through an angle of 45° (L.O.A. or R.O.A. to O.A.), or through one of 135° (L.O.P. or R.O.P. to O.A.). Rotation of the occiput to the hollow of the sacrum (O.P.) is rather uncommon and need not complicate the picture. Spontaneous delivery cannot be effected without this movement, which is caused in part by the conformation of the bony pelvis, and in part by the resistance offered by the levator ani muscles of the pelvic diaphragm.

Flexion.—Before descent begins, the fetal head is in a condition of partial flexion with the occipitofrontal diameter (11.75 centimeters) presenting at the inlet. At some stage in its descent between the inlet and the pelvic floor, resistance is offered to its passage and results in a marked increase in the flexion, so that the chin comes to rest upon the chest wall. As a result, the suboccipitobregmatic (9.5 centimeters) is substituted for the occipitofrontal diameter, so that the head becomes practically smaller and its passage through the vaginal orifice is facilitated.

Extension.—The vaginal opening looks upward and forward from the main axis of the pelvic canal (Fig. 17), so that, when the head presents at its orifice, the direction of its course must be changed, for, otherwise, it would be propelled through the perineal tissues. This movement of the head consists in a change from sharp flexion to extension, and is caused by two forces—descent is hindered by the resistant perineum and the head extends so that the occiput is directed through the opening. Extension is therefore essential to a spontaneous birth.

External Rotation.—After the head has been born with the occiput under the symphysis, the long diameter of the shoulders is at right angles to the vaginal slit. Within a few minutes, the shoulders rotate in such a way as to occupy the anteroposterior diameter and the head coincidentally rotates back toward the side from which it came (external rotation). This movement is instituted by the same forces which cause internal rotation.

Expulsion.—The anterior shoulder appears under the symphysis, while the posterior shoulder is pushed over the anterior portion of the perineum and is born first, after which the other is extruded and rapidly followed by the body and legs. As the child is expelled, the cavity of the uterus is obliterated by the contraction of its walls, and the organ is converted into a thick-walled structure completely filled by the placenta.

Mechanism of Labor in Vertex Presentations.—As has already been indicated, vertex presentations are by far the most common, and comprise about 95 per cent of all labors at term. The relative frequency of the various varieties is approximately as follows: L.O.A.—60%; R.O.P.—20%; R.O.A.—15%; and, L.O.P.—5%. It is generally held that the transverse varieties (L.O.T. and R.O.T.) are not primary, but represent posterior varieties which have undergone partial internal rotation. For this reason they are not included in the above enumeration.

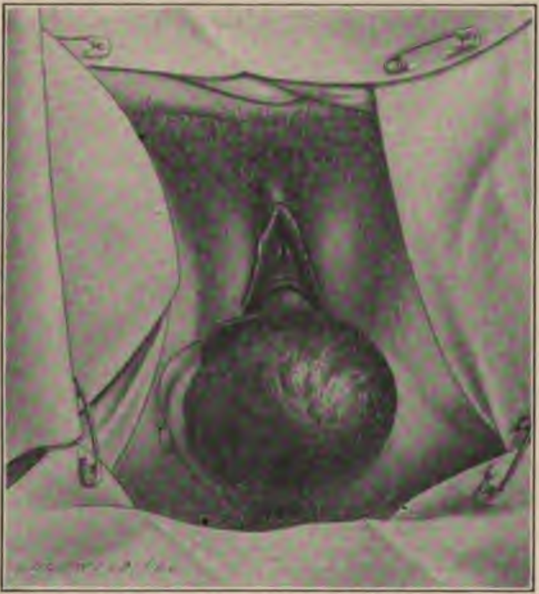


FIG. 63.—External rotation of the head—the shoulders have assumed the antero-posterior position. (Williams.)

When the occiput is in an obliquely anterior direction (L.O.A. and R.O.A.), the mechanism of birth is somewhat different from that of an obliquely posterior position (L.O.P. and R.O.P.). The two must therefore be considered separately.

L.O.A. and R.O.A.—In the anterior varieties of vertex presentations, engagement takes place with the sagittal suture in the right or left oblique diameter of the superior strait, the occiput being directed toward one or the other ilio-pectineal eminence. Descent is brought about by the usual forces and maximal flexion is produced when resistance is encountered. Internal rotation always occurs to the symphysis, so that the occiput passes through an arc of 45°. Extension, external rotation and expulsion occur in the manner already described.

L.O.P. and R.O.P.—The posterior position of the occiput introduces an essential difference in the mechanism. As the occiput is directed toward one or the other sacro-iliac joints, it is apparent that, in order for it to rotate to O.A., it must pass through an arc of 135° instead of 45°. This greater rotation may slightly prolong the second stage of labor, but otherwise is of no practical importance. Usually, internal rotation occurs when the head reaches the perineum, but occasionally it is delayed until the scalp is in sight, when the whole process is visible.

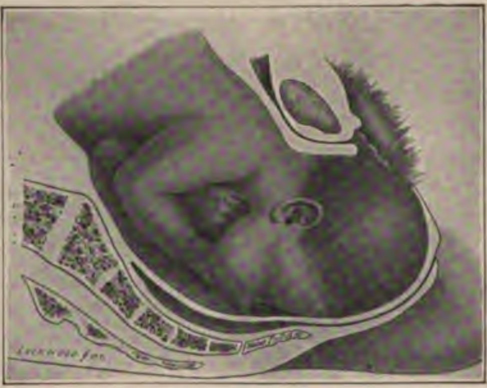


Fig. 64.—The occiput rotated under the symphysis—occiput anterior. (Williams.)

In about ten per cent of the cases, the occiput rotates posteriorly through an arc of 45° and comes to occupy the hollow of the sacrum. In such cases, spontaneous delivery is usual, but the head is born by a different mechanism. Flexion persists, and is even exaggerated, until the occiput is pushed over the perineum, then by a movement of extension it drops back toward the anus, while the brow, nose, mouth and chin successively emerge beneath the symphysis. The remainder of the birth proceeds in the usual manner.

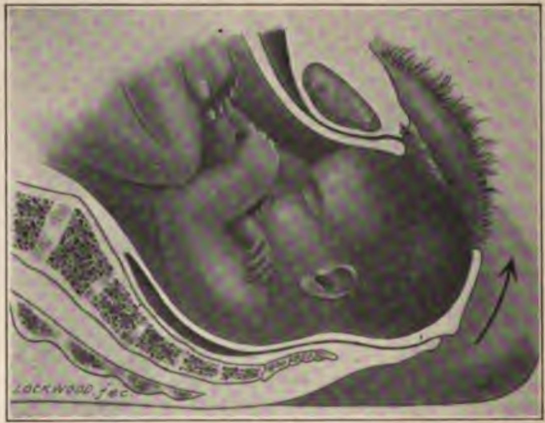


Fig. 65.—The occiput rotated into the hollow of the sacrum. (Williams.)

Occiput posterior positions are viewed with apprehension by many physicians, but do not deserve the importance given them. The average duration of labor is possibly slightly increased, but a spontaneous outcome is the rule, if the physician recognizes the condition and waits patiently for internal rotation to occur. With intelligent and conservative handling the maternal mortality is not increased over that noted in the anterior varieties, while the fetal death rate is scarcely appreciably higher.

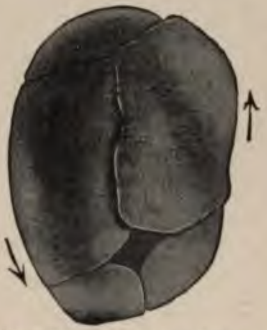


FIG. 66.—Manner of overlapping of the bones of the skull. (Williams after Tarnier.)

Changes in the Shape of the Head.—In vertex presentations, the prolonged pressure against resistance, which marks the passage of the head through the pelvis, results in definite and characteristic changes in the cranium. As the skull bones are only united by fibrous tissue at the various sutures and fontanelles, considerable motion is possible. Lateral pressure exerted by the walls of the birth canal compresses the head and tends to cause the various bones to overlap at the sutures. This *"molding,"* as it is called, usually follows a regular course: The frontal and occipital bones are pushed under the parietals, while the parietal bone which is nearer the sacrum (the posterior parietal bone) becomes overlapped by the anterior. This phenomenon is of considerable importance in that it leads to an appreciable diminution in the size of the head, so that, when the pelvis is slightly contracted, "molding" may make all the difference between a spontaneous labor and a difficult operative delivery.

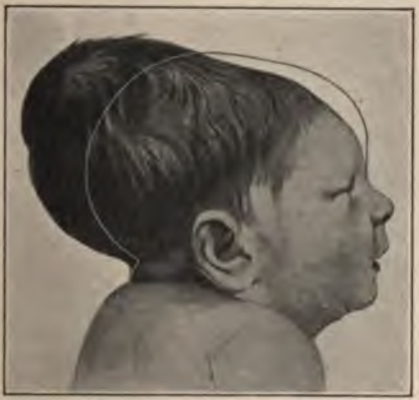


FIG. 67.—New-born child showing "molding" of head and large caput succedaneum over the vertex. Outline indicates normal shape of head. (Bumm.)

In prolonged labors the most dependent portion of the head may show a marked localized edema beneath the scalp—a *caput succedaneum.* This is more common in dry labors, where the pressure is borne directly by the scalp. Within a few hours after birth the serum is absorbed by the circulation and the swelling disappears, while several days must elapse before the effects of "molding" pass away.

Mechanism of Labor in Face Presentations.—Face presentations differ from vertex in that the head is fully extended, so that the occiput rests against the back and the face presents at the superior strait. The incidence is about one in 200 labors (0.5 per cent), and the most common varieties are L.M.A. and R.M.P., the face occupying the right oblique diameter of the pelvis. Extension usually occurs only after labor has begun, so that primary face presentations occurring during pregnancy are very rare. In general, face presentations may be said to be due to some factor which interferes with normal flexion, or which produces extension. Most commonly, it occurs when there is disproportion between the pelvis and the head, so that normal engagement is interfered with.

The diagnosis can be made upon abdominal palpation when the back and the cephalic prominence are detected upon the same side. During vaginal examination, the mouth, nose and eyes can be palpated if the cervix is sufficiently dilated.

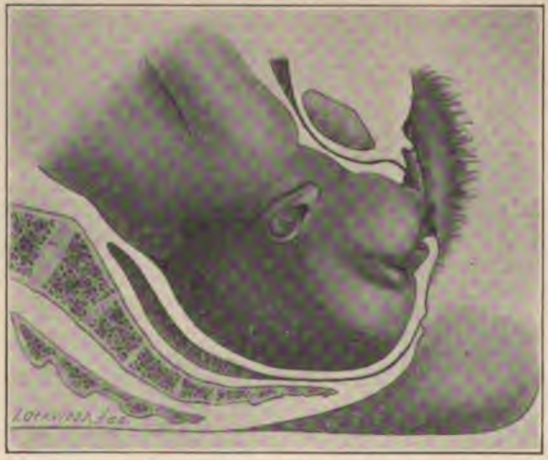


FIG. 68.—Face presentation with anterior rotation of the chin. (Williams.)

Descent occurs as usual, but flexion is replaced by extension, which tends to become more pronounced as the head descends and meets greater resistance.

Internal rotation serves to bring the chin under the symphysis, for only in this way can spontaneous delivery take place. This movement is instituted by the same factors as in vertex presentations, and may not occur until the face is distending the vulva. If the chin remains obliquely posterior, or rotates directly into the hollow of the sacrum, spontaneous delivery is impossible, unless the child is very small. For the chin to clear the anterior margin of the perineum, under these conditions, further extension would be necessary, but this is impossible, since it is already complete, with the occiput closely applied to the back. The successful treatment of this complication depends upon the manual rotation of the head, so that the chin is anterior, after which forceps may be applied. Failing this, a major operation is necessary.

Flexion.—In the usual case, after the chin has rotated anteriorly, it becomes stemmed against the symphysis and flexion occurs as a result of the descent being opposed by the perineum, and, when further progress occurs, the nose, eyes, brow and finally the occiput, come over the perineum.

External rotation and expulsion occur in the usual manner.

Spontaneous delivery is the rule in face presentations, but operative interference is more frequently necessary than in vertex presentations. The duration of labor, and especially of the second stage, is increased and results in a slightly higher fetal mortality. The maternal results are generally good, but there is a greater tendency to deep perineal lacerations. Posterior rotation of the chin is a serious complication, with a maternal mortality of about ten per cent and a fetal death rate of forty per cent.

The face is subjected to the pressure borne by the scalp in vertex presentations and frequently develops a marked edema, which partially obliterates the features. Occasionally the superficial capillaries rupture and blood is extravasated into the tissues, giving rise to a typical black-and-blue, bruised appearance, which persists for some days. The pressure tends to crush in the crown of the head, with the result that the skull becomes elongated in its mento-occipital and fronto-occipital diameters.

Mechanism of Labor in Brow Presentations.—Persistent brow presentations are extremely rare, once in every 1000 to 2000 cases. Diagnosis is best made by vaginal examination, since abdominal palpation gives results hardly to be distinguished from the findings in face presentations. *Engagement* most frequently takes place with the head in the right oblique diameter of the superior strait, and is always delayed. In brow presentations the longest diameter of the child's head —the occipito-mental—presents at the superior strait and cannot enter it until unusual "molding" has been effected. *Descent* is caused by the usual forces. *Internal rotation* serves to bring the brow anterior, and with the upper jaw against the symphysis, *flexion* forces the brow, and finally the occiput, over the perineum. The eyes, mouth and chin are then born by *extension,* and *external rotation* and *expulsion* follow in the usual manner.

A *caput succedaneum* is usually present over the forehead and the vertex of the skull is flattened, so that the fronto-occipital diameter is considerably increased.

The prognosis for both mother and child is bad unless the latter is small. There is a definite maternal mortality of 2 to 5 per cent, and a fetal death rate of 20 to 40 per cent. Vaginal delivery frequently leads to unusually severe perineal lacerations, by reason of the great distention of the vulva.

Mechanism of Labor in Breech Presentations.—It has already been stated that breech presentations occur in 3.5 per cent of all labors at term, but that they are much more frequent in premature deliveries. Multiparity, twins, and hydramnios predispose to their production. The diagnosis is made by abdominal palpation and confirmed by vaginal examination. *Engagement* takes place with the bitrochanteric diameter of the breech occupying an oblique diameter of the pelvis. As the right oblique diameter is usually involved, R.S.A. and L.S.P. are the most frequent varieties. *Descent* occurs normally, if no disproportion exists.

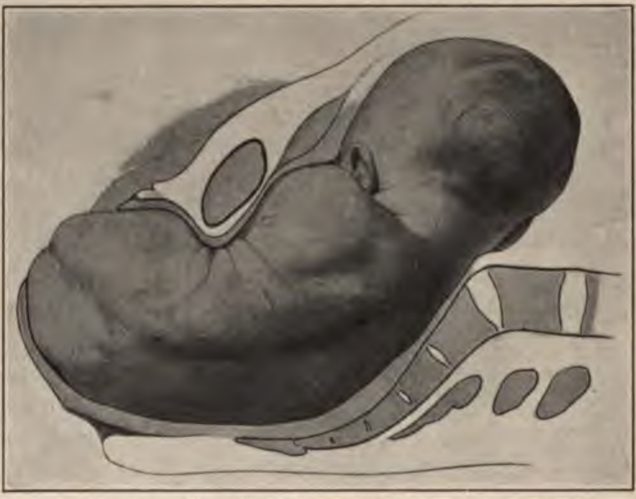


FIG. 69.—Breech presentation. (Bumm.)

Internal rotation occurring at the pelvic floor brings the bitrochanteric diameter into relation with the vaginal slit, and the anterior buttock first appears at the outlet. The posterior buttock is forced over the perineum by lateral flexion of the body and finally the anterior buttock is born. Descent continues until the shoulders are expelled in an antero-posterior position. *Internal rotation* now occurs so that the occiput comes under the symphysis, and *external rotation* occurs at the same time bringing the back of the child anterior. The neck is held under the symphysis, and the chin, eyes, brow and occiput successively appear over the perineum. Occasionally, when the occiput rotates into the hollow of the sacrum, flexion occurs and delivers the face from beneath the symphysis.

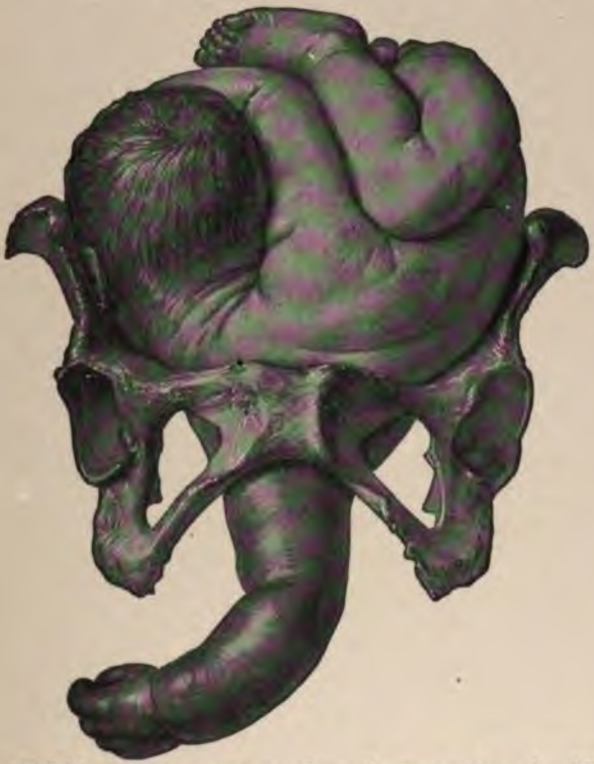


FIG. 70.—Child in transverse presentation—the arm prolapsed. (Williams.)

In primiparous individuals, the spontaneous delivery of a live baby is relatively uncommon, because of the great danger of fetal asphyxiation due to interference with the circulation in the umbilical cord. After the umbilicus of the child has cleared the vulva, the cord is compressed between the head and the pelvic brim. If, after this degree of extrusion has occurred, the completion of labor is delayed more than five minutes, the child is sure to be badly asphyxiated, and, if more than eight minutes elapse, it will be stillborn. Owing to diminished resistance of the soft parts, multiparae more frequently complete the birth process without assistance. In general, the patient is permitted to complete the delivery if possible, but the obstetrician must always be in readiness to interfere whenever the child's life is endangered. The ultimate prognosis for the mother is not worse than in vertex presentations, but about ten per cent of the children will perish in spite of expert care. Severe perineal lacerations frequently result from the sudden dilatation of the vulva during extraction of the after-coming head.

Labor in Transverse Presentations.—A mature child cannot be delivered spontaneously through a normal pelvis when the shoulder presents. If the presentation cannot be changed into a normal one by external manipulations during pregnancy or early in labor, the proper procedure is to perform podalic version as soon as the cervix has become fully dilated, and, if possible, as soon as the membranes have ruptured.

CHAPTER VIII

THE CONDUCT OF LABOR

General Considerations.—The physiological processes of parturition have been described in the two preceding chapters, but the method of conducting a normal uncomplicated labor still remains to be considered.

Hospitals to which obstetrical patients are admitted either provide a special delivery room or use a small operating room for the purpose. Usually a special room is available for patients during the first stage, while the delivery room is utilized only for the actual delivery. The conduct of labor in the home is a very different problem and must be considered separately. In the present chapter the more ideal hospital treatment will be discussed and details of furniture and supplies will be largely ignored.

Examinations During Labor.—As a preliminary examination was made during the few weeks preceding the onset of labor, the physician is already acquainted with the general condition of the patient, but intelligent supervision during labor entails careful observation of the changes which are occurring. Information concerning the child can be obtained by abdominal palpation and auscultation, but the progress of labor can best be followed by rectal or vaginal examination. When the patient in labor is first seen by the doctor, he will palpate the abdomen carefully to determine the position of the child and auscultate its heart in order to ascertain its condition. During the course of this examination he will also obtain objective information concerning the frequency and duration of the pains, and will then make a rectal examination to determine the extent to which labor has progressed, basing his conclusions upon the condition of the cervix and the descent of the presenting part. The nurse must be familiar with her general duties and with the requirements of the doctor, and should seek to anticipate his needs. She should never leave the room while the examination is in progress.

Abdominal Examination.—The patient should be in bed with the gown pulled up over the chest and the legs covered by a neatly arranged sheet, which should not be tucked in around the feet and sides. A stethoscope, a soft sounding towel and a pelvimeter should be within easy reach. Routine palpation ordinarily embraces the four maneuvers described in the previous chapter, page 115, and enables one to identify the fetal parts, to determine the presentation and position, as well as to ascertain the degree of descent of the presenting part into the pelvis. In addition, the duration of pregnancy and the probable size of the child can be estimated, while in cephalic presentations any disproportion between the size of the pelvis and child can be detected and its extent demonstrated.

Uterine Contractions.—Accurate objective information is always appreciated by the physician and the nurse should be able to give details concerning the character of pains her patient is having. A hand placed upon the abdomen can appreciate the hardening of the uterus several seconds before the patient is aware of it. Likewise, the sensation of pain ceases slightly before the uterus again becomes flaccid. The persistence of the unusual hardness of the uterus constitutes *the duration of a pain,* and the time from the beginning of one contraction to the onset of the succeeding one constitutes *the interval between pains.* These factors are rarely constant, but after a few pains have been observed it is quite simple to determine the average duration and interval. The degree of hardness attained by the uterus also varies, but considerable experience is needed before one can correctly appreciate such differences. The statements of the patient concerning the severity of the pains are of little value, because of the great individual variation in reaction to painful sensations, as well as because of the undoubted fact that some labors are much more painful than others. Pain is a subjective phenomenon and accordingly is of no great value in determining the progress of a labor.

Vaginal Examination.—During the last weeks of pregnancy, and especially during labor itself, vaginal examinations are attended by a definite risk of serious infection, and consequently should be made as rarely as possible, and then, only under strict aseptic precautions. It should be unnecessary to state that several examinations are more dangerous than one, just as one is more dangerous than none. *The nurse should never attempt vaginal examinations.*

The aseptic precautions include thorough cleaning of the hands of the examiner and disinfection of the region around the vulva. The latter is left to the nurse, who should always remember her great responsibility, and, if she makes it a rule to be as careful and as conscientious as possible, she will be saved from searchings of conscience in case her patient becomes seriously infected or even dies.

The actual technic employed may vary considerably without affecting its efficacy, but certain general principles may be emphasized. The patient should be placed upon a *clean* douche pan before the preparation is begun; this makes the region more readily available and prevents soiling the bed-coverings. The pubic hairs should be closely clipped with scissors or should be entirely removed by shaving with a safety razor. This facilitates more thorough cleaning of the area, and likewise obviates considerable annoyance to the patient during the puerperium when the vaginal discharges are very profuse. In shaving, small nicks in the skin should be guarded against, and the soapy water used to soften the hairs should not be allowed to enter the vagina.

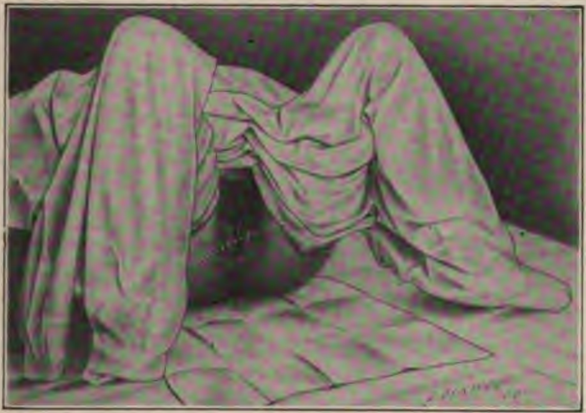


Fig. 71.—Method of draping patient for vaginal or rectal examination. (Williams.)

The inner surfaces of the thighs and the lower portion of the abdominal wall should be thoroughly cleansed with a gauze sponge, warm water and liquid soap as a first step. Liberal rinsing with clean water removes the soap and cut hairs. The vulval region should always be washed from above downward, and whenever a sponge has approached the region of the anus, it should be discarded. The folds around the clitoris and between the labia require special attention, but the vaginal mucous membrane should be carefully avoided, and the contaminated wash-water should not be allowed to enter the vagina. So far, the technic is universal, but the subsequent steps vary in different institutions. Alcohol (50 to 70 per cent) is frequently applied with a sponge to remove the excess soap. If only one sponge is used, it should be passed over the vulva from above downward with the first stroke and the subsequent applications made alternately on either side gradually moving out over the thighs.

The region should then be washed with an antiseptic solution (bichlorid of mercury 1 to 1000 or 1 to 2000, or lysol 1 per cent). after which a sterile towel, wet with the same agent, should be laid firmly over the vulva, and should extend from above the symphysis to below the anus. It may be held in position by a strip of adhesive binding its upper margin to the abdominal wall.

A similar perineal preparation is necessary before each vaginal examination and again before the patient is draped for delivery. The first "clean-up" takes at least fifteen minutes, but the subsequent preparation is much less time consuming.

Obstetricians are generally opposed to any attempts to disinfect the vagina during labor, and believe that it increases the likelihood of infection. This attitude is based upon experience, as it has been conclusively shown that post-partum elevations of temperature are less common if the "clean-up" preparations involve only the external structures.

After the patient is prepared as described, she is placed near the right or left edge of the bed, depending upon the side from which the physician customarily makes his examination, and is draped for that purpose. The long ends of a sheet folded diagonally are wrapped around the feet and the intervening portion covers the legs and lower abdomen, leaving the perineal region exposed. The old practice of examining under the bed coverings has been abandoned in the interest of better aseptic technic, and patients rarely object to the slight exposure entailed by this method.

The physician prepares his hands as aseptically as possible, according to his own routine. This must include thorough scrubbing with hand brush, green soap and hot water, particular attention being paid to the exposed portions of the hands and to the finger nails. After the hands are macroscopically clean, they are treated with 70 per cent alcohol, with lime and soda, or with a solution of potassium permanganate followed by oxalic acid, according to preference, and are then thoroughly soaked in 1 to 1000 bichlorid of mercury solution. Finally, they are encased in sterile rubber gloves. It should always be remembered that the skin can never be made absolutely aseptic by such procedures, but that the gloves can be entirely freed from bacteria after a hard boiling for five minutes. The preliminary hand scrubbing minimizes the danger of contaminating the gloves while they are being put on, and acts as a second line of defense if they are torn or punctured.

In making a vaginal examination, the fingers of one hand are used to separate the labia, while the first two fingers of the other hand are introduced into the vagina, care being taken to avoid the anal region. Sterile vaseline or 1 per cent lysol solution are commonly employed as lubricants. The examiner first feels the cervix, determines the condition of its canal, whether obliterated or not, and notes the degree of dilatation of the external os. At the same time he attempts to decide whether the membranes have been ruptured, and, if the cervix is sufficiently dilated, he should palpate the sutures and fontanelles of the skull or the outlines of the other presenting part to confirm his diagnosis of presentation and position, and, finally, any abnormalities should be noted. The descent of the presenting part into the pelvis is determined with reference to certain fixed points, the pelvic brim, the ischial spines and the perineum.

Rectal Examination.—Within the past twenty years it has been learned that with practice almost as much information can be obtained by rectal as by vaginal examination. Consequently, it is widely employed because of its time-saving features, but particularly because it eliminates the danger of infection. The patient is draped as for a vaginal examination, but no perineal preparation is necessary. The examiner, without disinfecting his hands, puts on a finger cot or a rubber glove, and using soap or vaseline for lubrication, introduces the index finger carefully into the rectum. Ordinarily, it is possible to obtain all the information outlined in the preceding paragraph, but occasionally, the thickness of the rectovaginal septum or the height of the presenting part may obscure the findings. In view of the mistakes sometimes made, it is always wise to confirm rectal findings by a careful vaginal examination before deciding upon any operative interference.

The Nurse's Duties During Labor.—The nurse must be constantly on duty during the entire period of labor, even though her actual nursing activities are, for the greater part of the time, minimal. Her great duty is to guard in every possible way against infection, as well as to reassure the patient in case she becomes discouraged with the prolonged pain and the apparent lack of progress.

The First Stage.—In most institutions the patients are admitted only when labor has definitely commenced, and are first seen by the nurse. Unless labor is obviously far advanced, a full bath should be given, and the patient clothed in a single loose garment before being taken to the delivery room. Tub baths should be avoided, and, unless a shower is available, a bed bath is advised.

Upon arrival in the labor room a simple soapsuds enema is given, and the pubic hairs are clipped or shaved. The former serves to empty the lower bowel and helps to prevent soiling of the vulvar region during the expulsion of the head. If delivery is delayed for more than twelve hours, the enema should be repeated, nor does the fact that the patient has spontaneously evacuated the bowels preclude the necessity for this treatment. The remaining steps in the "clean-up" technic should be postponed until the physician desires to make a vaginal examination, or until delivery seems imminent.

It is perhaps better for the patient to remain in bed until seen by the doctor. If his examination reveals nothing abnormal, she should then be encouraged to keep about until forced to return to bed by the severity of the contractions. The only definite danger from the upright posture consists in the possibility of prolapse of the cord, should the membranes suddenly rupture while the head is unengaged. Such circumstances are relatively rare, and the average patient will do much better if she is not confined to bed during the first stage. Between pains she will be quite comfortable, but when the contractions occur she will lean against some convenient article of furniture, and, as they become more severe, she may assume a squatting position as do other patients when having severe abdominal cramps.

Throughout the course of labor, the nurse should be certain that the patient voids at proper intervals, otherwise the bladder may become so distended as to interfere with the progress of labor, in addition to causing the patient unnecessary pain. It should be remembered that in late pregnancy, the bladder is an abdominal organ of limited capacity, and that the retention of even a few hundred cubic centimeters of urine distends it to such an extent that it becomes visible as a rounded tumor above the symphysis. When spontaneous voiding is impossible, the patient should be catheterized under order from the doctor. *A rubber catheter must always be used* under routine aseptic precautions. Glass instruments are avoided because of the danger that they may be broken off in the bladder by the sudden descent of the head during a contraction.

Food.—The majority of patients will refuse solid food during labor, but the short fast thus entailed has no harmful effect. Liquids, such as milk, cocoa, soup, or bouillon sometimes prove very acceptable and their use should be encouraged. Particular attention must be paid to securing a proper intake of water or other fluids. Increased perspiration and the heightened metabolism incident to muscular effort tend to concentrate the urine, and this should be avoided. We do not know that the metabolic products are harmful in themselves, but we do know that in toxemic conditions their excretion is interfered with, and that this serious complication rarely occurs when the urinary output is normal in amount.

Watching the Progress of Labor.—It has already been stated that the nurse must closely observe the duration, interval and intensity of the pains. She must also be able to judge when the physician should be summoned. The latter should leave definite instructions as to how he may be reached in case of emergency, but in any event he should be called at the beginning of the second stage in primiparae, or when strong pains recur at five-minute intervals in multiparae. The end of the first stage is commonly heralded by the rupture of the membranes and the change from nagging pains to those with bearing-down characteristics.

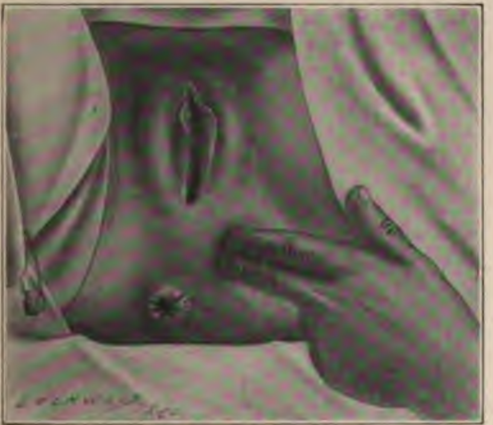


FIG. 72.—Palpating the advancing head through the perineum. (Williams.)

By palpation through the perineum, as indicated in Fig. 72, it is possible to feel the hard resistant head after it has descended nearly to the pelvic floor, and in this way to follow the progress of the second stage. Care must be taken that the fingers do not enter the vagina. By utilizing this procedure, the nurse may be able to note the advance of the head for some time before the scalp becomes visible between the labia.

Danger Signals.—When the nurse is intrusted with following the fetal heart, she should remember that the normal rate is 120 to 150 per minute, and that its rhythm is regular. A change in rate to below 100 or above 160 is generally considered to indicate fetal distress and should be reported at once. Fortunately, alarming variations in rate are rarely observed during the first stage. After the rupture of the membranes in a head presentation, the passage of meconium is of even greater moment as denoting fetal asphyxiation.

The mother's pulse and temperature should be taken every four hours. A rise of the former to 120 per minute, or of the latter to 101° F. (38.3° C.) indicates either maternal exhaustion or intra-partum infection. Vaginal bleeding, other than the usual "show," severe headache or indistinct vision are all signs of the most serious moment and should immediately be called to the attention of the physician.

The Second Stage.—After the first stage has been safely passed, all interest centers on the actual delivery of the child. At this time the requirements of the individual doctor are variable, but an attempt will be made to indicate the chief points in the technic, so that the nurse will have a fair idea of what may be required under usual circumstances.

Delivery is effected with the patient on a high single bed or on a specially designed delivery table. The patient is best clothed only in a single loose gown of knee length, which opens in the back, and is provided with tape ties instead of buttons, because they are less uncomfortable. A loose blanket is used if additional warmth is required. The mattress on the bed or table is protected with rubber sheeting covered by an ordinary sheet free from wrinkles. A small hard pillow supports the head. Suitable receptacles are placed near at hand on the floor for soiled sponges. A small movable table for sterile supplies and instruments is arranged conveniently to the operator. Supplies for the anesthetist are placed within his reach and all necessary sterile things are kept where they can be quickly procured. A tub of hot water (110° F.) and another of cold tap water should be in readiness for use, if the child is badly asphyxiated. A basket for the baby and a basin for the afterbirth complete the usual arrangements. Good light is essential, and a plentiful supply of fresh air should be assured, but without exposing the patient to a draft.

The patient is commonly placed in the *lithotomy* position, or the *lateral* position. The former is preferred, in this country, because it is more convenient, and delivery can be completed without a change of position. Fig. 71, illustrating this posture, shows the patient on her back with the knees flexed and the feet separated. The wrists may be confined in loose padded straps attached to the sides of the table or the patient may hold the loops at the ends of wide linen tapes extending from the foot of the bed. Such contrivances give her something to pull against during the expulsive pains, and by limiting the movements of her hands serve to prevent accidental soiling of the sterile dressings.

In the lateral, or continental, position, the patient lies on her left side, so that the left part of the face and chest rest upon the bed. The left arm is in front and is available for assisting in the bearing-down efforts. The buttocks are near the right edge of the bed or table and the knees are flexed upon the abdomen. A hard pillow is placed between the knees so that the doctor who stands or sits at the right of the bed may put his left arm between the thighs while restraining the advance of the head. If the hands are confined they should be attached to the left side of the bed out of the way of the operator. Fig. 73 shows the relative position of the patient and the physician.

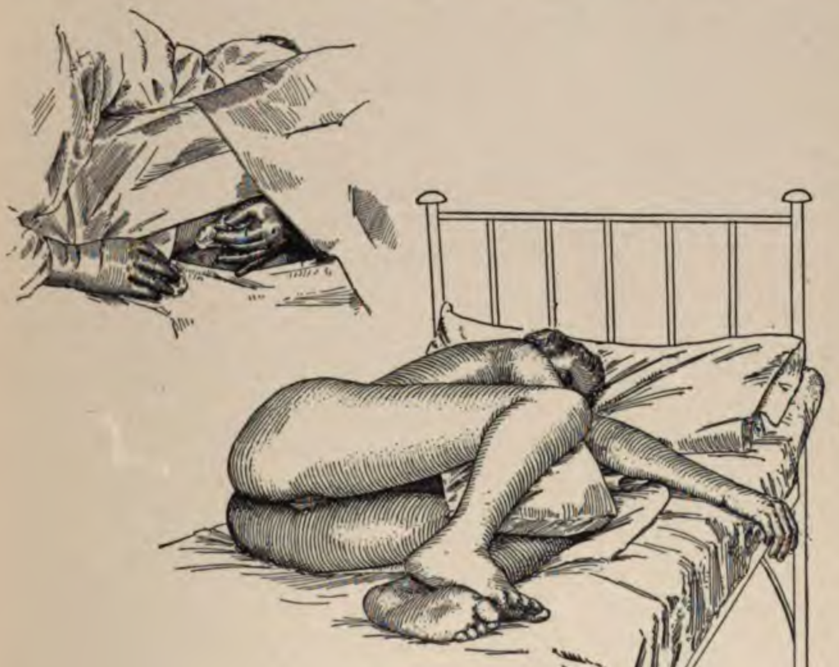


FIG. 73.—Patient in lateral position. Insert shows position of operator's hands during delivery.

Covering the patient and the bed with sterile dressings is essential to a satisfactory technic, but the methods actually employed are too numerous to be detailed. The dressings are put in position by the doctor, but the nurse is responsible for opening the packages and handing the contents to him.

A satisfactory and simple technic with the lithotomy position is as follows: After suitable disinfection of the external genitalia, a sterile sheet, doubled once across, is placed over the lower part of the bed, while the patient's feet are held out of the way in order to avoid contamination. The feet and legs are then encased in heavy wide obstetrical stockings and allowed to rest upon the sheet, whose upper fold is pulled well up under the buttocks. Towels are placed over the thighs with the edges near the vulva and are held in place with sterile safety pins passed through the stockings. A third towel is arranged over the lower abdomen. In this way the field of operation is exposed, but everything adjacent to it is sterile, so that the doctor's hands may not be contaminated. If any part of the dressings becomes soiled by contact with an unsterile object, it must be replaced or covered with extra towels.

If the lateral position is to be used, the stockings should be applied and the large sheet spread, before the position is assumed. After the operator has passed his left hand between the thighs, he can, with the unengaged hand, cover the necessary area with towels held in place by dressing clamps.

The side table, within easy reach of the operator, carries the few things needed for an uncomplicated delivery. They should include a generous supply of dry sterile sponges, a few extra towels, a basin of antiseptic solution and a tray of instruments. The physician will select the instruments he desires. Three large clamps (straight or curved), two pairs of scissors, two tissue forceps, a needle holder and an assortment of curved cutting needles are generally quite sufficient. They, together with material for tying the cord and silkworm gut for sutures, are sterilized by boiling for five minutes, and are kept covered with a sterile towel until needed.

Mechanical Assistance During Labor.—The moral support afforded by the presence of a trained physician at the bedside of a parturient woman is a large factor in the popular demand for medical assistance. Although the majority of deliveries are spontaneous and could be completed without expert help, there is no doubt that various complications may unexpectedly occur, even in the course of what promises to be a normal labor. In such circumstances, the presence of an obstetrician may mean the difference between life and death, so that, even when his services are not urgently needed, his presence may be regarded in the light of an insurance policy.

Protection of the Perineum.—During the first stage of labor little can be done, but when the actual delivery is to be accomplished, the attendants are fully occupied. Experience has shown that very rapid delivery frequently results in laceration of the perineum, consequently, when the head appears at the outlet, preparations must be made for restraining its advance and for assisting the normal mechanism. Slow but continuous progress of the head is desired, so that the vulva may be distended gradually instead of suddenly. The anesthetic is administered during each contraction, and, as soon as the presenting part has half distended the vulva, it must be grasped by the fingers of one hand in such a way as to prevent its sudden extrusion during a severe expulsive effort, and under constant manual control it is permitted to progress

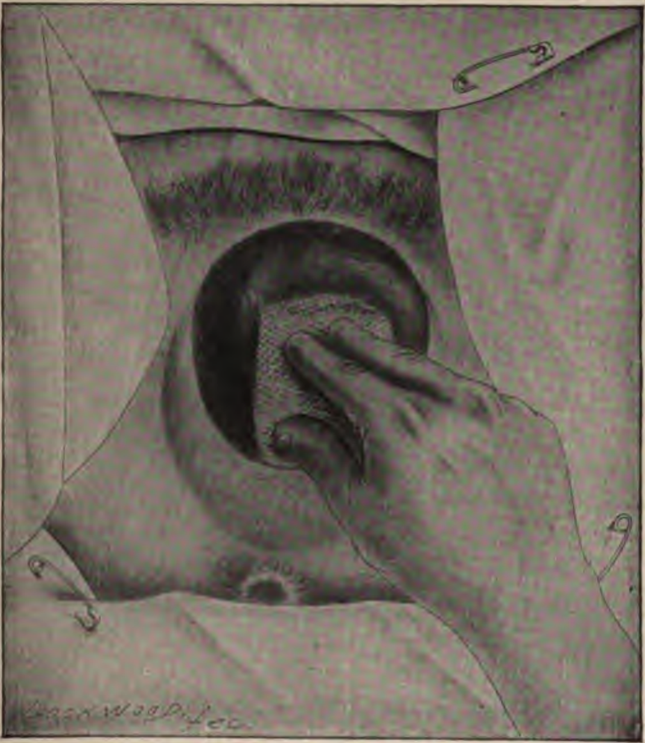


FIG. 74.—Restraining the advance of the head. (Williams.)

a bit with each pain. The head will recede between pains until it is sufficiently far out so that the parietal bosses are caught under the rami of the pubic bones. The unemployed hand may support the distended perineal body, but it is doubtful whether it has any effect in preventing tears.

Manual Expression of the Head.—When the vulva begins to be distended, the patient should be completely anesthetized, and when the distention is complete, the physician should deliver the head manually by Ritgen's maneuver, instead of allowing it to be born spontaneously. In this procedure, the operator, with two fingers applied to the perineum just behind the anus, presses upward and forward on the orbital notches of the fetal head through the intervening tissues. Gradually the eyes, mouth and chin are pushed over the perineum and the head is born. The gloved hand is saved from contamination by the employment of a sterile towel between it and the anal region.

Coils of Cord about the Child's Neck.—As soon as the head is completely born, a finger is passed around its neck in the search for loops of cord. In about every fourth case, the umbilical cord will be found coiled one to four times around the neck. In this event, the coil is drawn down and slipped over the head before delivery of the shoulders it attempted. Occasionally, the coil is too tightly applied to permit this procedure, when it must be cut between two clamps and the child extracted immediately. This release of the cord is not absolutely essential, but it tends to obviate the danger of asphyxiation from too tight constriction and possibly prevents interference with the extraction of the shoulders and body.

Birth of the Shoulders.—Except in cases of emergency, external rotation should be allowed to occur spontaneously. When the bisacromial diameter of the shoulders corresponds to the vaginal opening, downward traction will bring the anterior shoulder under the symphysis. Then by moderate upward traction the posterior shoulder is drawn over the perineum and upon lowering the head the anterior shoulder drops out. During this maneuver the head must not be bent too much upon the shoulders, as it may lead to injury of the nerves in the cervical region which supply the arm, and a birth palsy of the extremity may result. Following the birth of the shoulders, all obstacles have been overcome and the body and legs are promptly born.

The Third Stage.—The first part of the placental stage usually proceeds spontaneously, so that the attendants can busy themselves with the care of the child and with the repair of any existing perineal lacerations. In the absence of excessive bleeding, the uterus should be left strictly alone, except that it should occasionally be palpated to make certain that it is contracting well, and to note when the fundus rises following separation of the placenta. Constant massage of the uterus during this period does more harm than good, by producing abnormal contractions which interfere with the normal mechanism of placental separation. Traction upon the cord is only to be condemned—it may do serious harm but never any good.

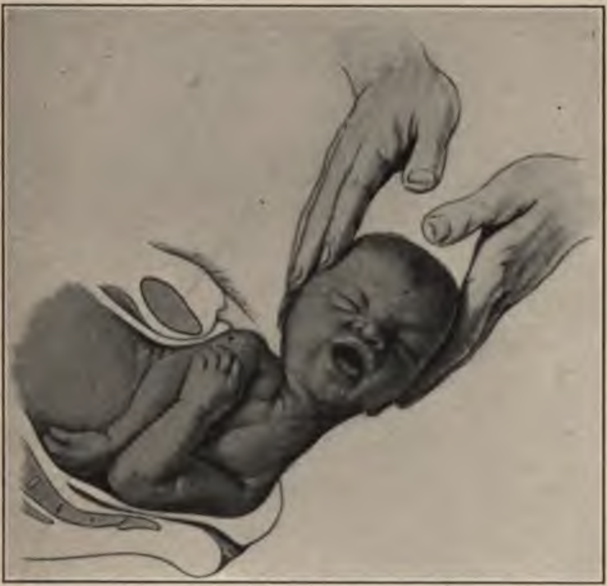


FIG. 75.—Delivery of the shoulders—upward traction. (Bumm.)

As has been stated previously, the placenta usually separates from its attachment to the uterine wall within fifteen minutes and passes into the lower uterine segment and upper part of the vagina. This separation is indicated by a considerable rise in the height of the fundus, as well as by an increase in the length of the exposed part of the umbilical cord. After these changes have occurred the fundus of the uterus is grasped through the abdominal wall with the four fingers behind and the thumb in front (Fig. 76), and firm pressure is made along the pelvic axis. The uterus is not kneaded or compressed, but is simply employed as a piston to expel the placenta, which is lying free in the lower part of the birth canal. Most of the blood which is normally lost during the third stage escapes at this time. The fetal membranes—amnion and chorion—trail out after the placenta as a loosely twisted cord. Unless they follow with slight traction, care should be exercised to effect their complete removal. If they begin to tear, they should be grasped with a clamp and twisted into a rope, when their extraction will be facilitated. Occasionally they may become caught in the angle between the body of the uterus and the cervix, when backward pressure on the former through the abdominal wall will effect their release.

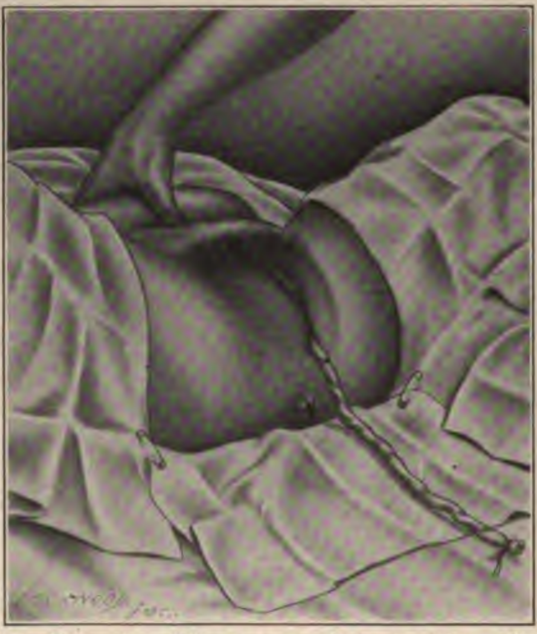


FIG. 76.—Expression of the placenta after separation. (Williams.)

A careful examination of the placenta and membranes should always be made immediately, to ascertain whether they have been expelled intact. Retained membranes call for no particular treatment, but the retention of even a small portion of placental tissue is so liable to cause trouble during the puerperium, that it should be removed digitally at once, but under the strictest aseptic precautions.

Care of the Child.—The normal infant cries immediately after birth and thus expands a considerable portion of its lungs. It is, however, wise to make certain that the respiratory tract is free and that respirations are well established. For this purpose, the physician generally wipes out the mouth and throat thoroughly with a bit of gauze drawn over the finger tip, and encourages deep breathing by some form of sensory stimulation. The child is frequently held suspended by the feet and slapped over the back and buttocks with the flat of the hand. Vigorous rubbing along the vertebral column or snapping the soles of the feet with the finger acts equally well and does not spatter the bystanders.

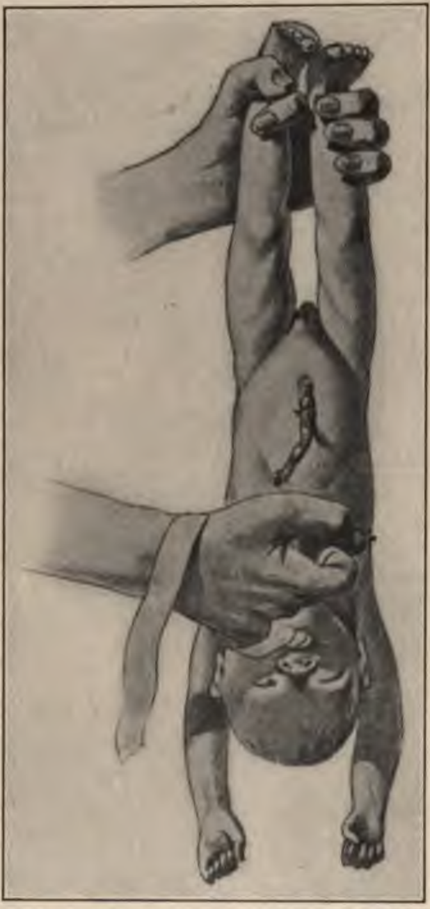


FIG. 77.—Clearing mucus from the child's mouth and throat. (Berkeley and Bonney.)

Care of the Umbilical Cord.—Except in emergencies, the umbilical cord should be left free until the pulsations in its vessels have ceased, as experiment has shown that during this time a portion of the blood in the vessels of the cord and placenta gains access to the fetal circulation, so that the child begins its life with an ounce or more blood than it would otherwise have. When the pulsations can no longer be detected a few centimeters from the child's abdomen (they cease first at the maternal end), the cord is seized with two clamps and cut between them. As a permanent safeguard against hemorrhage, the cord is now ligated with sterile bobbin an inch or two from the child's abdomen, the clamp is removed and the tissue cut close to the ligature. Various more or less complicated knots have been devised for this purpose, but, practically, a snug surgeon's knot is perfectly satisfactory. A sufficiently long stump of cord should be left, so that another ligature may subsequently be applied, should bleeding occur as a result of the loosening of the first ligature following the shriveling of the cord in the few hours just after birth.

The clamp on the maternal end should be left in place until the placenta has been expelled. It serves mainly to prevent soiling of the field by the blood which may flow from its severed vessels, although the absence of direct connection between the maternal and fetal circulations renders it impossible for the mother to lose any blood, should this precaution be omitted. In single ovum twins, however, where the circulations anastomose freely, it is conceivable that the unborn twin might bleed to death from the unligated end of the cord of the first child.

The dressing for the cord consists of a sterile gauze sponge applied so as to cover completely its cut end, and retained in position by a wide flannel binder passing a few times about the child's body and fastened with safety pins. Narrow strips of adhesive plaster may be utilized for the same purpose. Various antiseptics are advised for the dressing (alcohol, aristol, tincture of iodin, boric acid, etc.), but it is doubtful whether they have any virtue other than that supplied by the sterility of the gauze sponge.

Care of the Eyes.—The frequency of gonorrhea among pregnant women and the disastrous effects of gonococcal infection of the eyes of the newborn, makes it imperative that prophylactic measures be employed in every case, whether gonorrhea in the parents is suspected or not. From one quarter to one third of the inmates of our schools for the blind owe their blindness to gonorrheal ophthalmia. Fortunately, it can be almost entirely prevented by the employment of Credé's method or some modification thereof, which in many states is made compulsory by law. The eyes are wiped clean with a sponge and are then retracted so that a drop or two of 1 per cent silver nitrate, 5 per cent protargol, or 30 per cent argyrol can be introduced into each eye. The excess is not washed out, but is automatically squeezed out by the reflex closing of the lids.

Preservation of the Body Heat of the Infant.—The body of an infant presents a relatively large surface area per unit of weight and consequently, if left exposed, loses its body heat very much more rapidly than an adult. The smaller the child, the more rapid and more serious is this radiation. In order to limit it, the child should be wrapped in a warm blanket as soon as possible and placed in a bassinet with hot water bottles (110° F.). With an occasional inspection to see that its respirations are normal, the baby can now be disregarded until the mother is made comfortable.

The Hour Following Delivery—Atonic Bleeding.—For the first hour following delivery *the nurse should never leave the patient* even for a moment. The danger of post-partum hemorrhage from atony of the uterus is practically confined to this period, and constant supervision should always be enforced. Even though the third stage was normal, and the physician has left the patient quite satisfied with her condition, the nurse must let nothing interfere with this rule. At frequent intervals she should palpate the uterus through the abdominal wall and if it shows any tendency to softening, or if the fundus rises above the umbilicus, vigorous massage must be employed to encourage satisfactory contraction. If this fails, recourse may be had to drugs—fluid extract of ergot, drams ii, or ergotole, dram i given by mouth, or ergotole m xxx, or pituitary liquid, 1 ampule, injected hypodermatically into the muscles of the thigh, the point of injection being gently massaged for a few minutes to facilitate absorption and to lessen the danger of abscess formation. The latter drug produces a more prompt result and is generally to be preferred in this emergency. Pituitary extract acts very promptly, but its action persists for less than twenty minutes, whereas the preparations of ergot act more slowly, but persist for much longer periods. Frequently they are given simultaneously, so that each may supply the deficiencies of the other.

Such measures for the control of bleeding can be undertaken by the nurse without specific orders from the physician, but she should promptly notify him of the condition; for if these measures are not followed by the desired result, other more radical procedures to be discussed under post-partum hemorrhage will be necessary, and can be safely and intelligently employed only by the trained physician.

Anesthetics.—Since 1847 anesthetics have been employed to relieve suffering during the last part of labor and at present the practice is quite universal in this country. New drugs and improved methods of administration are continually being advocated in the attempt to give satisfactory relief from pain with minimal harmful consequences. Each procedure has its advocates and opponents and the controversy is still being enthusiastically waged. A nurse should be familiar with the essentials of the most important anesthetics, but can only learn the details of their actual administration from a trained anesthetist.

Chloroform was the first anesthetic to be introduced into obstetrical work and is still the most widely used. It is a powerful and dangerous drug and must always be employed with great caution. It should be kept in a tightly stoppered dark bottle to prevent deterioration, which is accompanied by the formation of very irritating hydrochloric acid gas. For the administration, a chloroform inhaler covered with a single layer of Canton flannel or other substantial cloth is employed (Fig. 78). The skin of the face should be protected by a thin application of vaseline or cold cream and the eyes covered with oiled paper. At first the mask is held a few inches from the face and then is gradually brought lower until it finally rests upon it, or it may be held a quarter of an inch from the surface.

Air should never be excluded, as in ether administration, by the use of a wet towel. Chloroform should always be given by the drop method and one should always be able to count the drops as they fall. Shaking the bottle is not good technic, as it is impossible to tell how much is being poured on the mask.

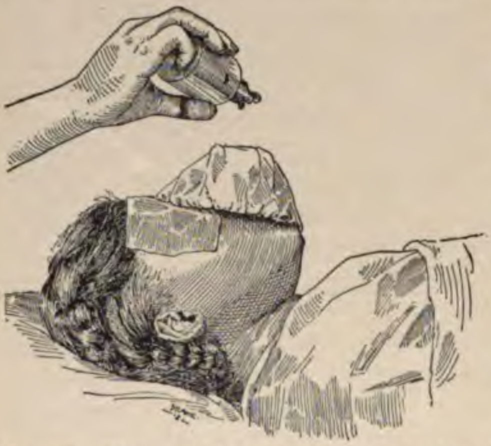


FIG. 78.—Giving chloroform—the eyes protected and the mask resting gently upon the face.

The pupils give the best index of the depth of anesthesia; when they are dilated but react to light, the patient is well anesthetized; but when they fail to react promptly the danger point has been reached and the mask should be removed. When an individual does not go to sleep after the administration of a quantity usually sufficient to produce complete anesthetization, the drug should not be forced, but another should be tried instead, as such patients have an idiosyncrasy to the drug and are liable to be fatally poisoned.

For the induction of the usual obstetrical anesthesia (chloroform à la reine) a dozen or so drops are placed on the mask at the onset of each pain and the patient is instructed to breathe deeply. After a few inhalations the sensibility to pain is greatly reduced, while the patient remains semiconscious and responds to commands. When the head is about to be born, complete anesthesia is induced by a few minutes' constant but slow administration of the drug.

Chloroform cannot be given with safety over long periods of time, so its use should be limited to the last part of labor. In primiparae, its administration may be begun when the perineum begins to bulge, and, in multiparae, when the cervix is fully dilated. By following this plan partial anesthesia need not, in the usual case, be maintained for longer than one hour, while complete anesthesia can be limited to the few minutes required for the actual delivery. The total period of administration should not exceed one hour and a half.

The advantages of chloroform are that it requires no elaborate apparatus for its administration, that anesthesia is quickly induced, and is rarely followed by disagreeable after effects. These are in part offset by the danger of serious and sometimes fatal poisoning which may result from its prolonged administration, especially when the patient has an idiosyncrasy to the drug.

Ether is quite widely employed in institutional work very much in the same manner as chloroform. Greater amounts are necessary to produce results, but there is no danger of a specific poisoning effect. In its administration, the mask is fitted tightly to the face and the air partially excluded, in order to obtain a greater concentration of the fumes. It should not be used near an open flame and is generally not suited for use in the tropics because of the rapidity with which it vaporizes. After effects are quite prominent and some obstetricians believe that its use is responsible for a certain amount of asphyxiation of the newborn. It is safer than chloroform for the patient, but much less potent.

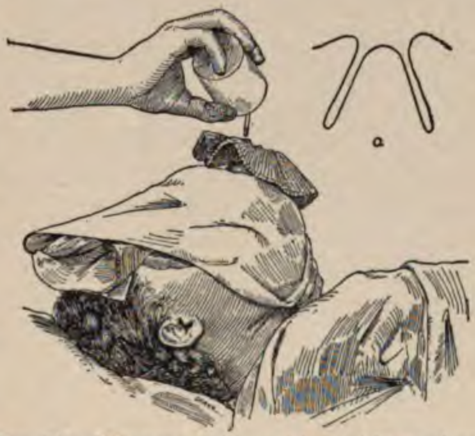


Fig. 79.—Ether mask in position with towel applied to concentrate the fumes.

Gas and oxygen has recently come into favor, and, for institutional work, is nearly ideal. The necessity for the employment of a cumbersome apparatus and the cost of the gases will, however, always limit its scope. It may be given with impunity with each pain for several hours before delivery, as prolonged administration seems to have no deleterious effect on either the mother or the child, and labor is not appreciably slowed. During the actual delivery of the child, ether is mixed with the gas and oxygen, or given separately, so that the patient is completely anesthetized.

Twilight sleep is the latest addition to the pain-relieving procedures. By the repeated administration of small doses of scopolamine, supplemented by an occasional injection of morphine, the patient becomes amnesic. The uterine contractions still cause pain, which is somewhat deadened by the morphine, but all memory of them is immediately lost by reason of the scopolamine action. During the actual delivery a general anesthetic is given. The treatment may be begun early in labor, when the pains recur at five-minute intervals, and may be continued for twelve hours or more. Labor is generally conceded to be somewhat prolonged, and there is possibly a slightly increased danger to the child. The patient is restored to her normal mental condition within a few hours and is noticeably free from all signs of physical and nervous exhaustion otherwise so frequently observed. The procedure is a time-consuming one, whose success depends upon individualization of patients and the constant services of an expert physician.

Spinal anesthesia has been successfully given to obstetrical patients, but has never become popular because of the difficulties of administration and the dangers inherent in the procedure. Attempts to "block" the perineal nerves by local injections of cocaine or novocaine have never proved successful.

Perineal Lacerations and Their Repair.—Even though the perineal body has been prepared during pregnancy for the stretching it must undergo during the birth process, it usually gives way to some extent, especially in the first labor. If slight separations of the vaginal mucous membrane and skin are classified as lacerations, practically all primiparae would be included. In a certain percentage, however, the lacerations are very superficial and require no attention.

The frequency with which the separation involves the deeper structures depends largely upon the skill of the operator, although in the presence of a very large fetal head or a very resistant and inelastic perineum, even the greatest expertness will not always prevent lacerations.

Excluding the minor injuries involving only the skin and mucous membrane, the lacerations extend posteriorly through the perineal structures to varying depths, generally slightly to one side of the mid line. *First degree tears* are those which extend down to the perineal muscles, but without involving them. They appear as ragged open wounds rarely more than 2.0 centimeters ($^4/_5$ inch) deep. *Second degree lacerations* involve the perineal muscles and frequently expose the sphincter ani, while the *third degree or complete lacerations* extend through the sphincter ani and usually involve the anterior wall of the rectum.

Incomplete tears (first and second degree) are frequently encountered, and it is safe to say that the former occur in 40 to 50 per cent, and second degree tears in 5 to 10 per cent of all primiparae, while complete lacerations should never occur during spontaneous delivery. With proper care, they generally heal very promptly, and rarely cause any disability. Operative interference always increases the incidence of perineal injuries. Child-bearing renders the perineum permanently less firm and resistant and greatly reduces the incidence of lacerations among multiparae.

In very rare instances the perineum is so high that the advancing head penetrates through its substance, leaving the fourchet intact and giving rise to a *central tear*.

Immediate repair of all lacerations is imperative. As the patient is already anesthetized, time may be saved by making the repairs while waiting for the separation of the placenta. Incomplete tears can be sutured without a change of position, if the patient's hips are elevated on a sterile douche pan, but, for more extensive injuries, the patient must be placed cross-wise on the bed or be drawn to the edge of the table, while the knees are held by a leg-holder. Good light is absolutely essential for satisfactory work.

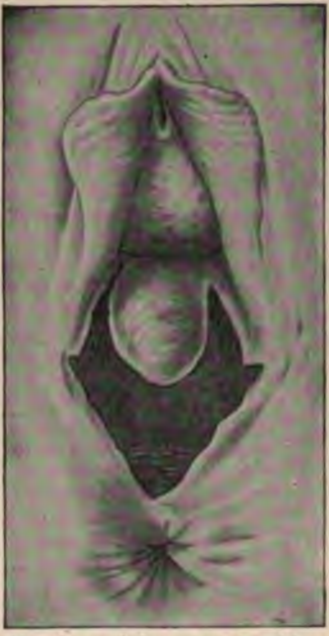


FIG. 80.—Second degree perineal laceration. (Williams.)

Chromic catgut is a suitable suture material. The deeper structures are brought together with interrupted sutures and the perineal body gradually restored. The tears in the skin and mucous membrane are closed with interrupted or continuous sutures of the same material. Stay-sutures of silkworm gut are sometimes passed deeply through the tissues and tied on the skin surface. The operation should be made as near "clean" as the circumstances will allow. When the rectum and sphincter ani are torn, the former is repaired with silk sutures tied on the inside, and the separated ends of the muscle are approximated with the same material. The subsequent steps of the procedure are similar to those outlined for the repair of incomplete tears. The results are sometimes poor because of contamination by the feces, and in such cases a secondary operation must be done later to restore control of the bowels.

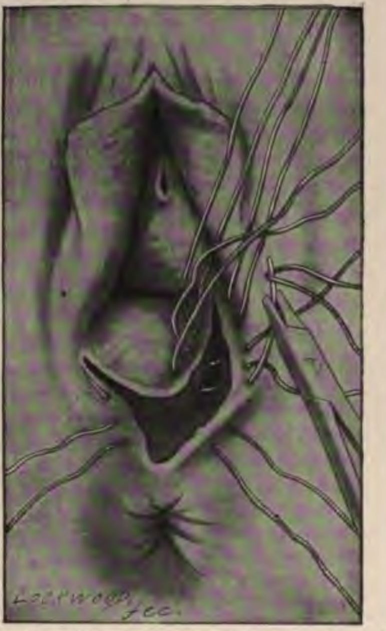


FIG. 81.—Repair of second degree perineal laceration—uniting the mucous membrane. (Williams.)

The after-care of repaired incomplete lacerations does not differ from that ordinarily given. The perineum is cleansed in the usual manner and care is taken not to disturb the sutures. The tissues frequently become quite edematous within a few hours, but if the sutures have been tied sufficiently loosely they do not cut through and healing is not delayed. This edema usually subsides within three or four days at the latest. After repair of a complete tear, the bowels are not permitted to move for several days, so that the injured sphincter has an opportunity to heal. Ordinarily, the failure to give a cathartic will lead to the desired result but, occasionally, it will be necessary to give some form of opium to prevent defecation. When it is deemed advisable to open the bowels, a saline cathartic is given and followed by a medium-sized oil edema to soften the fecal masses, so that the dilatation of the sphincter will be moderate.

CHAPTER IX

THE NORMAL PUERPERIUM

The *puerperium* comprises the period following the birth of the child, during which the maternal organism returns to its normal non-pregnant condition, and is usually completed in six weeks. The more important changes occur during the first ten days, a period characterized by more rapid and extensive retrogressive changes than occur in any other physiological process. Although the anatomical changes are usually completed within six weeks, it is not uncommon for several months to elapse before the woman really regains her full strength, even in the absence of any complication.

ANATOMICAL CHANGES DURING THE PUERPERIUM

Involution of the Uterus.—*Involution* is the term applied to the changes occurring in the puerperal uterus, which lead to its restoration to the conditions prevailing before the beginning of pregnancy. At the completion of the third stage of labor, the uterus extends nearly to the umbilicus, forming a solid muscular mass about the size of a grapefruit, and weighs roughly 1000 grams (2 pounds), but two weeks later it has atrophied to such an extent that it can be accommodated within the pelvic cavity and has become reduced to 350 grams ($^3/_4$ pound) or less in weight. During the next few weeks the retrogressive changes continue at a slower rate, so that at the end of the puerperium the organ has regained its normal size and weighs 50 grams. Involution is more rapid when the child is suckled, and occasionally an excessive autolysis of the tissues may result in a definite atrophy—*lactation atrophy*—which is rarely permanent, so that the uterus regains its usual size and takes up its normal function shortly after nursing is stopped.

The growth of the uterus during pregnancy is due largely to a hypertrophy of the individual muscle cells making up its substance and to a lesser extent to the formation of new muscle cells. During involution all of the muscle cells rapidly lose some of their protoplasm and shrink to their former size; it is not believed that many of them completely disappear. In all probability the atrophy of the cells is brought about by the action of an autolytic ferment, which attacks the protoplasm and forms soluble degeneration products that are absorbed into the blood stream and eliminated through the kidneys. This view is substantiated by the marked increase in the excretion of urinary nitrogen observed during the period of acute involution.

Degeneration of the Decidua and Regeneration of the Endometrium.—When the separation of the placenta and membranes from the uterine wall occurs through the spongy portion of the decidua, a thin layer of the latter remains *in situ*. Most of these remnants degenerate early in the puerperium and are cast off in the lochial discharge, but a few of the glands persist deep down between the muscle bundles and are surrounded by a small amount of stroma. From these latter elements the new lining membrane, the endometrium of the non-pregnant uterus, is rapidly developed. The degeneration of the superficial layers and the regeneration of the deeper tissues proceed simultaneously, but during the first ten days the former process predominates. When involution is not retarded by a uterine infection or by malposition of the organ, the

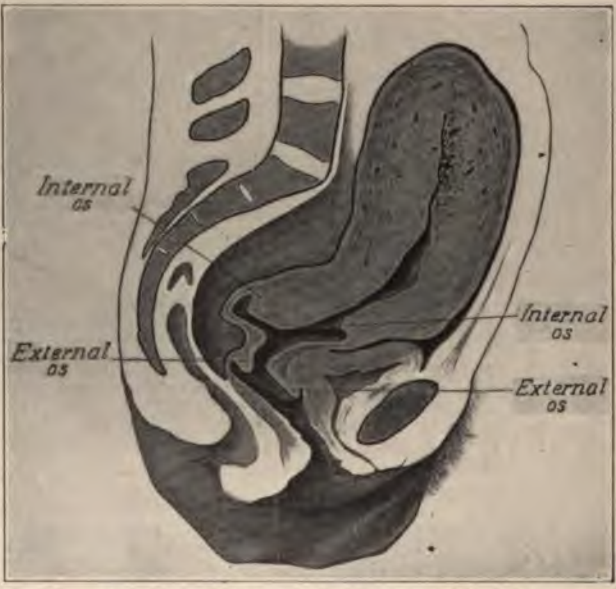


Fig 82.—Sagittal section of genital tract of a freshly delivered woman. (Bumm.)

new endometrium is completely formed by the end of the second week after the birth of the child.

Changes in the Uterine Blood Vessels.—The extremely abundant blood supply of the enlarged uterus develops gradually during pregnancy, by reason of a slow hypertrophy of the existing vessels. After delivery the organ requires only a small proportion of the blood it previously received, so that its vessels must undergo a compensatory diminution in size. Retraction and contraction of the uterine muscle temporarily effects this by compression, while the blood contained in the vessels coagulates to form thrombi. Eventually a degenerative process entirely obliterates the lumina of the arteries and a new vascular system is developed in their degenerated core. The newly formed vessels are of a caliber suited to the needs of the non-pregnant organ.

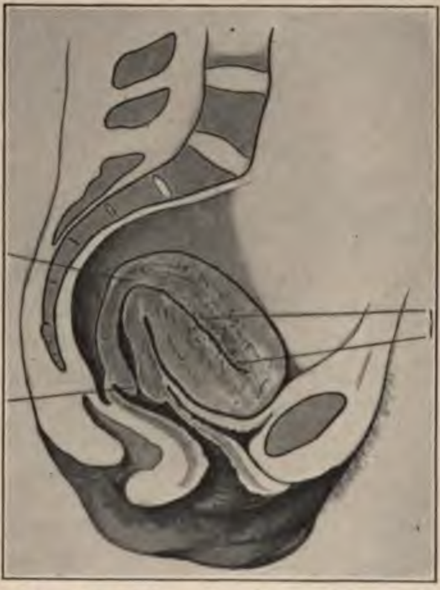


FIG. 83.—Sagittal section of genital tract of a woman twelve days post-partumm. (Bum.)

Changes in the Cervix and Vagina.—Both of these structures have been enormously dilated during labor, and it is only after some weeks that they return to their non-pregnant state. At the end of labor the lower uterine segment is soft and flabby, but within a week or ten days it has regained part of its lost tone and has so contracted that the external os barely admits a finger. From this time onward the involution process proceeds more slowly. The vaginal tissues likewise slowly recover from the effects of the distention at birth and within a month the canal is of normal dimensions, although it never returns to its virginal condition, while the rugae formerly present in the mucosa have largely disappeared. As a result of distention, the hymen has undergone pressure atrophy, and is represented only by small tags of tissue around the margin of the vaginal orifice—*the carunculae myrtiformes.*

Changes in the Peritoneum and Abdominal Wall.—The peritoneum overlying the uterus must likewise accommodate itself to the greatly diminished size of that organ. For a few days after labor it is arranged in folds which rapidly disappear because of the innate elasticity of the membrane. The round and broad ligaments also become very lax after the uterus is emptied, but by the time this organ is small enough to enter the pelvis they have regained their tone and again serve as efficient supports in maintaining it in its normal anteverted position.

Prolonged stretching of the abdominal muscles has deprived them of their tone and for some time after delivery they remain soft and flabby. This is usually only a transient condition, but occasionally it persists and causes considerable annoyance. Moreover, pregnancy frequently leads to a diastasis of the recti muscles, a condition which is permanent in character, but which causes no symptoms unless it is very pronounced.

The Breasts.—Early in pregnancy, under the influence of some blood-borne hormone, the mammary glands undergo marked hypertrophy and begin to function imperfectly, secreting a thin, yellowish fluid, *colostrum,* which can be expressed from the nipples. This continues throughout the latter part of the period of gestation, but early in the puerperium, on the second to the fourth day after delivery, the breasts become larger and firmer and suddenly begin to secrete milk. Anatomically, the secreting cells in the acini of the glands show signs of functional activity and the lactiferous tubules are filled with secretion. The distended lobes and lobules are palpable as small, hard nodules, which are painful on pressure. The blood supply to the glands is greatly augmented, so that the overlying skin becomes warm to the touch and may even appear slightly reddened.

The reason for the sudden secretion of milk shortly after the birth of the child is not entirely clear. A hypothesis which accords with many observed facts is the following: The internal secretion of the enlarged corpus luteum of pregnancy stimulates the mammary glands to their original early hypertrophy, but very shortly the growing fetus or placenta develops an antagonistic secretion which holds the former in equilibrium. This second influence disappears after delivery with the expulsion of the uterine contents, so that the stimulating action of the corpus luteum comes rapidly to the front and results in the establishment of the milk secretion.

Regulation of the Milk Supply.—Eliminating various factors, which may temporarily influence the amount of milk produced, the secretory activity of the glands varies according to the demands of the infant. Very shortly after the first excessive production in the newly functioning organs, a point is reached where the demand and supply are equal. As the child grows it requires progressively more food, and activity of the mammary glands tends to increase proportionately. Cases of under- and over-production are commonly seen, but in large part they are due to dietary errors.

Changes in Other Organs.—The *circulatory system* rapidly returns to normal after delivery, the heart regains its usual position and its slight hypertrophy disappears, while the blood volume is quickly reduced to normal. If the hemoglobin content of the blood and the number of red blood cells have been diminished, as they frequently are by the loss of blood during the third stage and during the puerperium, there is a gradual increase until the normal point is reached.

Hypertrophy of the glands of internal secretion incident to pregnancy soon disappears and the normal glandular balance is restored. The ovarian function is held more or less in abeyance during lactation, and menstruation does not appear for some months, while it is probable that ovulation does not occur during this period of amenorrhea.

Pressure phenomena in the extremities, such as edema and varicose veins, are relieved by the emptying of the uterus and rapidly disappear.

Pigmentation of the face, abdomen and nipples persists for only a few weeks and gradually fades, leaving the skin as before conception. Striations over the breasts and abdomen become less prominent when the distention is relieved, and soon are visible only as fine silvery white lines, which remain as permanent scars.

Clinical Aspects and Nursing Care.—It is essential that the nurse be familiar with the various clinical developments during the normal puerperium, so that she may not be needlessly alarmed by their appearance and yet may be able to recognize any abnormalities should they occur. Even though the patient is going through a perfectly physiological puerperium, she can hardly be judged by the usual criteria for normal individuals or for convalescents from various diseases.

Obstetrical nursing is recognized as being exacting and somewhat more difficult because of the added burdens imposed by the care of the infant. Even if the convalescence is uncomplicated, the mother requires considerable attention, while the demands of the newborn are more than sufficient to occupy the odd moments. The nurse's professional knowledge of the puerperal changes is useful in reassuring the patient and in explaining, when necessary, the rationale of the treatment employed. By a common-sense application of her information she can do much to make the time spent in bed seem quite essential and can discourage the rebellious thoughts which often arise when the initial fatigue and nervous strain have disappeared. The ability to give moral support and encouragement is a large factor in the success of an obstetrical nurse.

Immediately after Delivery.—The imperative demand for constant attention during the first hour after delivery has already been emphasized. Usually the danger of atonic bleeding has passed by the end of that time, and the nurse may attend her other duties; but, if the uterus remains soft and flabby, it should be stimulated until its condition is satisfactory—a duty which has precedence over all others.

Post-partum Chill.—Frequently a patient will experience a definite chill without an accompanying elevation of temperature. This phenomenon is probably of nervous origin and has no significance. It rarely perists for more than half an hour, and is quickly relieved by the use of hot-water bottles and extra blankets. Later in the puerperium, a chill usually indicates the onset of an infectious process and should at once be called to the attention of the physician.

Temperature and Pulse.—The mechanism for heat regulation is slightly deranged during the puerperium, and, as slight elevations above 98.6° F. (37.0 C.) but below 100.4° F. (38.0° C.) are frequently observed without any cause, a new normal mouth temperature has been arbitrarily established at the latter figure. On the basis of this standard, the puerperium is designated as afebrile, if this point is not reached during the first two weeks after delivery, while a rise above it is regarded as *prima facie* evidence of an infectious process. Puerperal infection is the most frequent, as well as the most dreaded, cause of temperature during the puerperium, and will be considered in detail later, but other infectious processes are at times responsible.

Occasionally, during or just after a prolonged or difficult labor, there is a transient elevation of temperature, which usually drops to normal within twenty-four hours and does not rise again unless other factors come into play. A more pronounced elevation, which is also more persistent, may indicate that intra-partum infection of the uterus has occurred.

It was long held by the profession that the inauguration of the milk secretion was accompanied by a considerable elevation of temperature—so-called *milk fever*. Since the introduction of antisepsis and asepsis, we have learned the fallacy of this explanation, and now attribute such febrile reactions to beginning uterine infection. The older view is still held by many of the laity, but educated physicians have long since abandoned it for the more logical but more disturbing explanation just offered.

In perhaps 25 per cent of women undergoing a normal puerperium, the pulse is definitely slower than normal, averaging between 50 and 70 per minute, while, occasionally, a decrease to 40 or 50 per minute is observed. Multiparae exhibit this *puerperal bradycardia* more frequently than primiparae. The enforced rest in bed and the diminished work demanded of the heart following the emptying of the uterus are the most obvious causative factors.

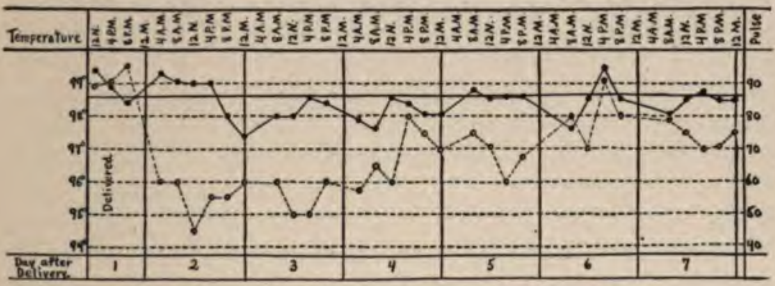


FIG. 84.—Chart showing puerperal bradycardia.

Increased pulse rates are observed following prolonged and exhausting labors as well as in those complicated by an unusual loss of blood. Neurotic individuals likewise tend to have tachycardia.

Since the early recognition of an infectious process is very essential and an elevation of temperature is frequently the first sign of its presence, the temperature and pulse should be taken every four hours for the first ten days and a record kept for the physician. Variations up to 100.4 F. are insignificant, but anything above that should be reported immediately. During the first three to five days, fever may indicate the onset of puerperal infection, whereas later rises are frequently due to infected breasts. Both conditions, as we shall see later, demand prompt attention. Except when otherwise directed, the mouth temperature is taken.

After-Pains.—After-pains occurring during the 48 hours following delivery are relatively common in multiparae but infrequent in primiparae, unless the uterus has been unduly distended by twins or hydramnios. Occasionally, they persist for several days, particularly when the child is at the breast. After-pains are due to the presence of blood clots or other material in the uterine cavity, and recur at intervals as the organ contracts in an effort to expel them. When the cavity is empty the muscle remains in a state of tonic contraction and the pains do not occur. Multiparae are more frequently annoyed because the uterine muscle is poorer in tone, a condition which permits periodic relaxation and allows the escape of small quantities of blood which promptly clots.

The remedies employed should aim at removing the cause as well as relieving the pain. Repeated firm contractions of the uterine muscle will squeeze out the existing clots and prevent the formation of others. This may generally be brought about by the use of ergotole (dram i, q. 4. h. ad doses VI) by mouth, supplemented by the application of an ice-cap over the lower abdomen. The pain can be controlled by opiates (morphin grain $^1/_6$ or codein sulphate grain i, q. 4. h.), but hypodermic injection is rarely necessary.

The Lochia.—The vaginal discharge present during the early part of the puerperium is known as the *lochia*. It is composed largely of blood and degenerated decidual tissue and decreases rapidly in amount as the puerperium advances. During the first few days following delivery it is more profuse and dark red in color—the *lochia rubra*. As the bleeding from the uterus ceases, it gradually becomes paler—*lochia serosa*—and finally, after the tenth day, it is small in amount and of a dirty white color—*lochia alba*. It has a peculiar and quite characteristic odor, which becomes foul only if infection with putrefactive bacteria has occurred.

The secretion taken from the uterine cavity under aseptic precautions is normally sterile during the first week, but later it contains harmless saprophytic organisms which have made their way upward from the vagina and the vulva.

Persistence of a reddish discharge for more than two weeks is generally associated with poor involution of the uterus, which is usually due to retained fragments of placenta or membranes, uterine infection or malposition of the uterus, particularly retroflexion. In a later chapter more details will be given.

The total quantity of the lochia lost during the entire period varies from 500 to 1000 grams (1 to 2 pounds). In general it is less profuse in women who nurse their children. The previously mentioned fact that suckling stimulates uterine contractions probably accounts for this difference. The decrease in the flow from day to day can be roughly measured by the number of perineal pads which are necessary to absorb the discharge. During the first twenty-four hours ten to twelve pads will be found necessary, for the next three days perhaps six daily and, by the tenth day, only two. In many cases it will be necessary to wear a pad for some weeks to prevent soiling the clothing.

Perineal Toilet.—After the completion of delivery, the soiled dressings are removed from beneath the patient and the vulval region is freed from blood with a generous gauze wipe or towel dampened with plain water or an antiseptic solution. A sterile cotton and gauze perineal pad is then applied and held in position by a T-binder, and replaced as frequently as necessary.

During the development of the aseptic technic, great stress was laid upon the necessity for frequent washing of the vulva with antiseptic solutions as a preventive against puerperal fever, and it was insisted that the perineum must be disinfected whenever the pads were changed, as well as after each urination and defecation. Many different procedures have been devised, and various antiseptic solutions employed. The best that can be said for them is that if the manipulations are so made that none of the wash fluid enters the vagina, and the exposed sutures are not disturbed, no harm will be done.

Recent investigations, however, have demonstrated that the best results are obtained when the attention to the perineum is reduced to the minimum consistent with the usual standards of personal cleanliness. A wash-cloth with warm water and soap furnishes a simple method of obtaining macroscopic cleanliness. For the first few days the nurse or the patient can do this twice daily, but later a single cleansing at the time of the bath is sufficient. No antiseptics are employed. Care is exercised not to pull upon the stitches, but no special attention is paid them.

Five years' experience with this "let alone" method has demonstrated that the results are better than with the older procedures, even in the presence of extensive perineal repairs. The percentage of lacerations which heal by first intention is slightly improved and never has there been any evidence of an infection attributable to the method. Particularly in institutional work, the actual economy of the nurse's time is an item of greatest importance.

Perineal Repairs.—Perineal repairs should be inspected daily and a note made of their general appearance. The great majority heal kindly and need no particular care. Non-absorbable sutures, especially those of silkworm gut, should be removed at the end of ten days. A pair of fine pointed scissors and a clamp, together with a few sponges, comprise the instruments necessary for their removal. They should be sterilized, but no perineal preparation is necessary. The patient may be placed upon a douche pan to obtain better exposure and draped in the usual manner with a sheet.

The Urine.—The output of urine increases soon after delivery, reaching a maximum on the second or third day, and then gradually diminishes to normal, thus following very closely the process of involution. This increased output is accompanied by an augmented excretion of the various nitrogenous end products of metabolism resulting from the dissolution of the uterine substance. Normally there is no retention in the body, as the kidneys have no difficulty in removing these substances as rapidly as they appear.

Very frequently the systemic strain of labor results in the appearance of a slight transient albuminuria which has no significance. Casts may also be found, but generally disappear within 24 hours. Voided specimens of urine during the period when the lochial discharge is profuse are rarely of any value because of the inevitable admixture with blood. Consequently, when a urinary examination is of importance, the specimen should be obtained by catheterization.

After the milk secretion is established, the urine frequently contains a trace of lactose, which may give an atypical reaction with the usual sugar tests. Lactose is not normally present in the blood and therefore does not ordinarily appear in the urine. During lactation it is formed in the mammary gland for secretion in the milk and at times small quantities are absorbed into the blood stream, where it cannot be utilized but is speedily excreted by the kidneys. Its only significance is that its accidental detection sometimes leads to an erroneous diagnosis of diabetes.

As the puerperium frequently represents the woman's first experience as a bed patient, the necessity for using a bedpan may be annoying. Spontaneous voiding within 12 hours should be encouraged and the patient may even be supported in a sitting posture, if otherwise unable to urinate. Catheterization should be employed only as a last resort and should be postponed until all other measures have failed or until the bladder is recognized as a soft tumor rising above the symphysis. When catheterization is indicated, it should be carried out under strict aseptic precautions; fortunately, its repetition is rarely necessary.

Occasionally, more or less constant dribbling of urine may occur in the presence of a markedly distended bladder—*paradoxical incontinence.* This condition should be suspected whenever a patient voids only small quantities at frequent intervals, and the diagnosis is assured by the recognition of the enlarged bladder in the lower abdomen. Catheterization is indicated and the administration of a tonic drug such as strychnin for a few days will overcome it by improving the tone of the bladder musculature.

Increased Skin Activity.—Early in the puerperium the skin becomes unusually active and perspiration is frequently very profuse. Night sweats may occur, but are without any special significance. Possibly the condition is a provision of nature designed to relieve somewhat the task imposed upon the kidneys. At any rate it ceases about the time the initial polyuria disappears. Daily bathing is, of course, necessary, and extra precautions should be taken to prevent "catching cold."

Food and Drink.—As relatively little food was taken during the period of labor, and as the fluid intake had probably been less than the output, there must be a physiological demand for both liquid and solid nourishment which should not be ignored. Unless there is an annoying nausea following the administration of an anesthetic (a very rare occurrence except after the use of ether), water may be taken *ad libitum*. Other liquids, such as tea, cocoa, soup and bouillon have no deleterious effects and are not contra-indicated.

Formerly, even normal obstetrical patients were kept on a liquid diet for the first twenty-four hours after delivery and on a limited soft diet for an additional two or three days. These restrictions are not necessary, and the patient's appetite furnishes an excellent index of her need for food. Consequently, the regular diet may be given with impunity whenever requested. In hospital wards a tray may be served at the next regular meal and the patient permitted to eat what she chooses. When facilities are available, as in private nursing, the expressed desires of the patient may well govern the nurse in the preparation of the various meals, particularly as the majority of patients have a diminished appetite for several days, so that there is no tendency toward overeating.

Objections to so full a diet are largely based upon a fallacy, as it has been argued that the kidneys have a sufficiently large task in the elimination of the products from the involuting uterus and that the food intake should be restricted to spare them. The normal kidneys are more than equal to such demands and suffer no derangement from this temporarily increased effort, whereas an existing impairment of their function naturally calls for a limitation of the demands made upon them and requires a restricted intake.

Preservation of the patient's strength and weight are important factors in a smooth and rapid convalescence, and should be fostered by a liberal diet. The strain of nursing will constitute a tremendous drain upon the mother's resources, and all body reserves of food and energy should be conserved. Simple nutritious food must be served, and there should be an abundance of milk, fruit and vegetables. Personal preference may largely determine the menus. Supplementary feedings between meals and at the night-nursing period are beneficial and should consist of a glass of milk or cup of cocoa with toast or a few biscuits. In general sweets can best be indulged in after lunch or dinner. More detailed suggestions concerning satisfactory diets will be given in a subsequent chapter.

The Bowels.—Two factors combine to make constipation extremely common during the early part of the puerperium: the enforced rest in bed and the relaxed condition of the abdominal walls. Daily evacuation of the bowels usually requires the use of medicinal measures. Failure in this respect rarely does harm, notwithstanding the general belief that it may cause various symptoms, and experience teaches that patients who are otherwise normal may go without a bowel movement for as long as seven days without any untoward manifestations. Temperature elevations during the puerperium are not infrequently attribued to constipation, but it is probable that they are rather the result of mild infectious processes in the uterus or elsewhere.

Nevertheless, except in the presence of extensive perineal repairs involving the rectum (complete lacerations), the bowels should be emptied on the second or third day. As spontaneous evacuation rarely occurs, some artificial measure must be employed. A simple soap-suds enema may be quite sufficient, but generally a rather vigorous cathartic is given alone or precedes the enema. For this purpose castor oil ounce i, compound licorice powder drams ii, Rochelle or Epsom salts ounce i, a bottle of magnesium citrate, or an equivalent dose of some other purgative, may be ordered. In some cases mineral oil, given in ounce doses twice daily, will produce regular evacuations, but generally an occasional active cathartic is needed until the patient is out of bed and resumes her usual life. Except on the first occasion, the milder laxatives are usually sufficient.

If a complete perineal laceration has been repaired, constipation should be encouraged for four or five days in order to facilitate healing of the torn sphincter muscle. At the end of this period several ounces of olive oil are injected into the rectum and followed in an hour or more by a soap-suds enema. The former will soften the fecal masses, while the latter will cause their expulsion without much danger to the suture line.

The Bed.—Generally labor is conducted in a separate room, or at least upon a bed other than the one which the patient is to occupy during her convalescence, so that after delivery she is placed in the already prepared clean bed. Nursing is facilitated by the use of a single bed of more than ordinary height, which should be made up in advance with its mattress protected by rubber sheeting or oilcloth, and with a large gauze and cotton pad placed over the sheet to absorb the discharges which may escape the vulvar dressings. If the delivery has been operative, the pillow should be discarded and sponges and a curved basin should be at hand in case there is post-anesthetic vomiting.

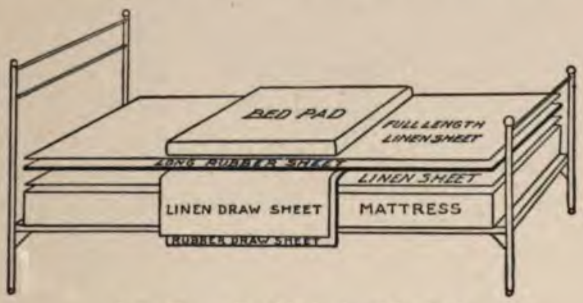


FIG. 85..—Double bed. (Cragin.)

The use of the same bed for delivery and convalescence necessitates the postponement of these arrangements until after delivery, or the employment of the "double bed." In the latter event, the "final bed" for the period of convalescence is first arranged and covered with a full-size piece of rubber sheeting, while the actual "labor bed" is arranged over it, so that upon the completion of delivery the removal of the soiled dressings and rubber sheeting leaves the patient upon the "final bed." The usual methods for changing the bedclothes, while the patient is in bed, will adequately solve the problem, and is most easily carried out after consciousness has been regained.

Rest and Quiet.—A feeling of physical and mental exhaustion normally follows delivery, particularly if the labor has been prolonged. As soon as the patient has been made comfortable in her clean bed, the room should be darkened and a long sleep encouraged, when the nurse can busy herself with the care of the child.

Most American authorities insist that the patient remain in bed for ten days or two weeks. The latter is preferable, but is generally objected to by primiparae, who frequently feel so well that arguments are useless. There is no objection to free movement in bed, nor to sitting up with a back-rest for meals, but the greater part of the time should be passed in the prone position and more than the usual amount of sleep should be secured.

Visiting should be restricted to the immediate family for the first four or five days, but later may be extended to include the more intimate friends. If the nurse believes that the number and the length of stay of the visitors puts too great a strain upon her patient, she should ask for orders limiting the list.

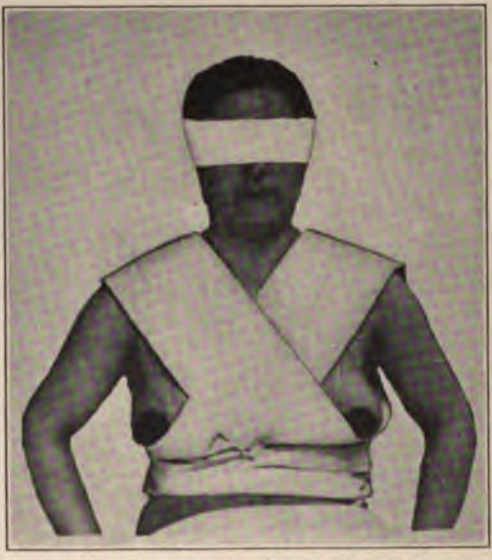


FIG. 86.—Towel support for breasts—front view.

Binders.—Abdominal binders have long been employed routinely in the belief that they promote involution of the uterus and help to preserve the figure. The many-tailed Scultetus bandage is most commonly used, and is applied shortly after delivery, and worn until the patient leaves the bed and can resume the corset. The actual value of the binder is doubtful, and there is no concrete evidence that it accelerates involution or improves the tone of the abdominal musculature. The logical method for developing muscular tissue is by exercise, whereas the binder, by limiting motion, would seem to have the opposite tendency, and so tend to defeat its own purpose. Occasionally, a patient with a very large pendulous abdomen will be made more comfortable by the application of a tight support, but the average woman derives no benefit from its use.

Large pendulous breasts may be supported if they become uncomfortable, but the routine application of a breast binder is not necessary. There is no particular virtue in the various special types of binders, and equally satisfactory results may be obtained by the use of ordinary towels as shown in Fig. 86, or by the employment of a brassière. When some support seems indicated, as in the case of engorged breasts, the need will generally disappear as soon as the child succeeds in emptying the glands more thoroughly.

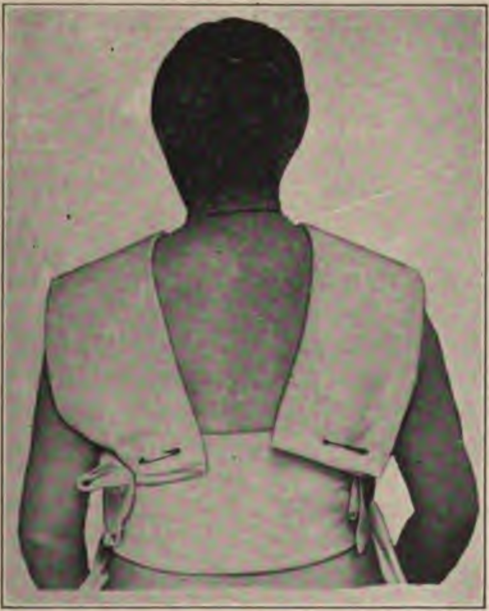


FIG. 87.—Towel support for breasts—back view.

The Breasts.—Ordinarily the breasts need little attention except perhaps a supporting bandage during the first few days. Very shortly they become soft and painless and regulate their secretions to the demands of the child.

The nipples, on the other hand, require constant supervision, lest fissures appear and lead to abscess formation. Hardening and toughening procedures as recommended during pregnancy are of considerable value, but in spite of them the nipples may be quite tender and sore for some days after nursing is begun and frequently cracks will occur. Intact nipples cannot become infected, but the slightest break in the skin opens an avenue for the entrance of bacteria and paves the way for the development of a breast abscess. To reduce the possibility of such a sequence of events, the nipples should be kept as free from bacteria as possible by careful washing with a harmless antiseptic solution. Saturated boric acid (4 per cent) is commonly employed before and after nursings, and a piece of sterile gauze is applied during the intervals. The value of this procedure must lie in the sterility of the solution and in the mechanical removal of the accumulated organisms, because the short period of application will scarcely suffice to destroy any virulent organisms. In fact, it is doubtful whether there is any utility in such treatment, for, in the absence of a crack, it can do no good, and, if a fissure develops, the secret of its successful treatment is prompt recognition and intelligent care.

Cracked Nipples.—Small cracks or fissures frequently appear on the nipples during the first few weeks of suckling as a result of the vicious chewing of the baby, when the mother will suffer agonizing pain during the nursing periods and a burning sensation may persist for hours afterward. The cracks are usually readily visible as small reddish depressions in the covering skin and may exude a few drops of bloody serum after the infant has suckled. Fever is not a part of the picture of uncomplicated cracks, but its occurrence indicates that the deeper tissues have become infected by organisms which have gained entrance through them. The susceptibility to cracked nipples is more marked in blond women, and particularly in those with such thin skin that the underlying veins are readily visible. Here even the most conscientious care during pregnancy may leave the skin too tender to withstand the repeated injuries incident to nursing.

All cracks in the nipples, irrespective of their size, are dangerous and demand prompt and faithful treatment, if the development of a breast abscess is to be avoided. This danger persists until the fissure is firmly healed and should not be overlooked. The first requirement is surgical cleanliness to prevent infection and that necessitates scrupulous supervision of everything coming in contact with the nipple, while other measures are being employed to promote healing.

Most effective of the curative measures is complete rest, but it is rarely used until other methods have failed. Practically every antiseptic drug has been advocated for healing the cracks, but none is uniformly successful. Silver nitrate solution, 5 to 10 per cent, aristol powder, compound tincture of benzoin, and bismuth paste with an oil base are most frequently employed. A single application of the first is made directly to the crack, whereas the other remedies are applied on sterile dressings between feedings and are removed by washing before the child nurses. Most authorities recommend that nursing be continued through a nipple shield. A glass shield with rubber nipple, as shown in Fig. 88, is quite satisfactory. It should be carefully cleansed and boiled after each using and kept in sterile water until needed. The holes in the nipple must be numerous and large enough to permit the easy withdrawal of milk by the infant—they can be made at will by passing a red-hot hairpin through the rubber. When a shield is employed, the nursing period should be doubled because of the slower flow of milk under these conditions. Massage with expression of milk, which is subsequently fed to the infant from a bottle, is falling into disuse, particularly because the manual manipulation of the breast tissue may result in slight injuries, which give rise to an area of lowered resistance and thereby favor the growth of any organisms gaining entrance through the fissure. The application of an ice-cap probably reduces the possibility of infection and certainly makes the patient more comfortable.

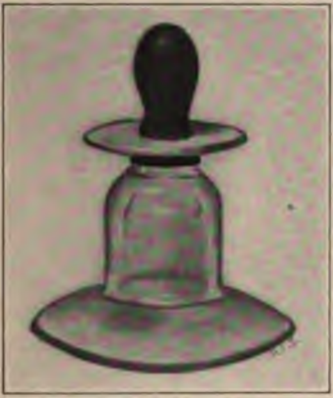


Fig. 88.

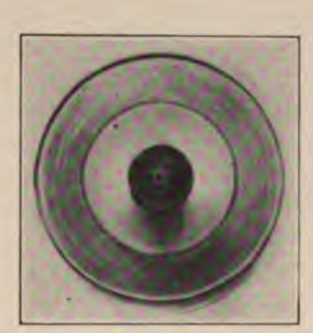


Fig. 89.

Fig. 88.—Glass nipple shield—side view.
Fig. 89.—Glass nipple shield—top view. Note large holes in nipple.

Caked Breasts.—This term is popularly applied to the engorgement of the breasts occurring during the few days following the establishment of the milk secretion. The glands become markedly distended and hard tender nodules are palpable, but the condition tends to disappear spontaneously as the child succeeds in withdrawing the milk and the supply is equalized by the demand. There is no elevation of temperature unless there is an accompanying mastitis.

Treatment is sometimes indicated, however, in an attempt to make the patient more comfortable. This can be accomplished by compressing the breasts against the thorax by a tight binder and by the applications of ice-caps, while the pain can be relieved, if necessary, by codein sulphate, grain $^1/_2$ to 1. The secretion of milk may be temporarily diminished by the administration of a saline cathartic and the restriction of fluids by mouth. The child is encouraged to nurse as much as possible. The employment of massage and breast pumps is illogical and certainly does no good. As previously stated, the secretion of milk is largely regulated by the demands of the child, and the procedures mentioned tend to stimulate increased production, whereas a diminished flow is sought. They undoubtedly do afford temporary relief, but experience has shown that the engorgement is controlled quite as effectively and more rapidly when they are omitted.

Contra-Indications to Maternal Nursing.—Certain diseases or conditions in the mother may definitely contra-indicate any attempt to suckle the child. Chief among these are constitutional diseases, such as tuberculosis, diabetes and chronic nephritis, in which the mother's lowered vitality will not endure the strain of nursing without the danger of serious harm. Malformed nipples occasionally offer an insurmountable mechanical difficulty, and again some women have mammary glands which are functionally so defective that a satisfactory milk supply cannot be established, even with a carefully supervised diet. The diagnosis of functional disability should only be made after persistent efforts have failed to remedy the condition. In very rare instances the character of the milk is totally unsuited to the needs of the child and cannot be made satisfactory by dietary changes, so that after prolonged experimentation one is reluctantly forced to resort to artificial feeding.

Exercises in Bed.—In the absence of a perineal repair or of other contra-indications, the puerperal woman is undoubtedly benefited by certain regular exercises begun while she is still in bed and continued afterwards. The abdominal muscles particularly are relaxed and require special attention, but the rest of the body should not be neglected. Bed patients are limited by the prone position, but various systematic movements are possible for them. For example, the knees may be raised and lowered, the head lifted from the pillow and slowly lowered, the shoulders turned to either side while the hips remain stationary, and, finally, the arms may follow some of the regular calisthenic movements. When the patient is again walking, more elaborate attempts are possible, more particularly those which involve the abdominal muscles. The nurse may well supervise such exercises, but should always be on guard lest the patient really become fatigued, while the patient should be encouraged to persist in them as the best method for restoring her figure and for getting rid of superfluous fat.

Vaginal Douches.—In general, vaginal douches have no place in the management of the normal puerperium. They are distinctly contraindicated during the first week on account of the possibility of the introduction of infected material into the uterine cavity, and afterwards are valuable only in certain abnormal conditions, which will be considered later. Consequently, they should never be given without specific orders.

Loss of Weight.—Pregnancy generally results in a gain of weight above that attributable to the growth of the uterus and its contents. At delivery, the expulsion of the child, placenta, cord and amniotic fluid, plus the amount of blood lost, suddenly diminishes the weight by 4000 to 7000 grams (8.8 to 15.4 pounds). Moreover, approximately 900 grams (2 pounds) are lost through the lochial discharge during the period of convalescence. Considering these as inevitable losses which do not materially affect the state of the patient's nutrition, her condition at the end of the puerperium will depend largely upon the amount and character of the food ingested. If a limited dietary régime has been enforced, a more extensive loss is probable, but, with a full diet, there should be no definite puerperal loss of weight.

Getting Up.—The time-honored custom in this country is for the patient first to be allowed out of bed on the tenth day after delivery. Generally, this excursion is limited to one hour in a chair, but on each succeeding day the time is doubled, so that by the end of the second week she is up nearly all day, and is then permitted to walk about the room. During the next two weeks the ordinary life is gradually resumed, but walking up or down stairs is prohibited. Thereafter, all restrictions are removed, but the patient is cautioned against becoming overtired, and is encouraged to form the habit of resting for an hour each day, preferably just after lunch. Three weeks in bed and six weeks on one floor would be better, but it is impossible to convince the average woman of its advantages, though it may be said that multiparae are more amenable in this respect than primiparae.

The Reappearance of Menstruation.—The popular idea that menstruation is suppressed during lactation and that, if the flow does appear, the child must be weaned, is erroneous. Statistics teach that about 70 per cent of nursing mothers will menstruate before the child is six months old and can continue to suckle it without its nutrition being affected; while in only 20 per cent does the function remain suppressed until after the child has been weaned. If the child is stillborn, or for any reason the mother does not suckle it, the menstrual flow usually reappears within eight weeks after delivery. Frequently this first period is abnormal, being too scanty, too profuse, or of too long duration, but, in the absence of pathological pelvic conditions, the normal standard for the individual is soon reëstablished. If the patient had suffered from dysmenorrhea before becoming pregnant, the symptom is frequently permanently relieved by the obstetrical experience, so that in the future the periods are remarkably free from pain.

Examinations During the Puerperium.—At the end of two weeks, when the acute part of the puerperium has passed, many physicians make a pelvic examination, principally to determine the degree to which involution has proceeded and the extent of any injury to the pelvic floor. If such abnormalities as sub-involution, or profuse leucorrheal discharge are present, they may be treated by a course of vaginal douches, while retropositions of the uterus are corrected by the introduction of a pessary.

The involution processes are not completed by this time, however, and experience has shown that certain abnormalities may develop later. For that reason, a so-called "discharge examination" should be made six or eight weeks after delivery. At that time, the final results of the labor may be recognized, and, if abnormalities are present, appropriate treatment should be instituted. This examination is of fundamental importance, and should always be insisted upon, as experience teaches that many conditions may be relieved at that time by simple means which, if neglected, may call for operative measures months or years later.

CHAPTER X

THE NORMAL CHILD AND ITS CARE

Description of the Normal Newborn Child.—A mature newborn infant averages 3250 grams ($7^1/_4$ pounds) in weight, with extremes of 2500 and 4500 grams ($5^1/_2$ and 10 pounds), and measures 50 centimeters (20 inches) in length. The layer of subcutaneous fat is well developed and the body is rather plump in appearance. Because of the prolonged maintenance of the characteristic posture *in utero,* the attitude for some weeks after birth is one of general flexion with marked bowlegs as a prominent feature. The scalp has a greater or less covering of temporary hair, the color of which gives no indication of the permanent growth. All babies have slate-blue eyes by reason of the absence of a defining pigment in the iris. The special senses, except taste, are poorly developed, and there is little or no response to light, sound, smell and touch. Pain is appreciated so slightly that operative procedures can frequently be undertaken without the use of an anesthetic. Various reflex paths are operative, however, and for some days at least the child should be regarded largely as a spinal animal. Most prominent of the reflexes are sucking and grasping, the former being especially necessary for the life of the child. Certain glands, such as those of the intestinal tract, are ready to function, but others are conspicuously inactive, more especially the tear, sweat and salivary glands. There are no teeth, except in rare instances, when imperfectly developed specimens may be present. The temperature (rectal) is 99° to 100° F., the pulse 120 to 150, and the respirations 40 to 50 per minute.

Principal Anatomical Changes at Birth.—When the child is separated from its mother, it enters upon a period of independent existence, and certain changes are necessary to fit it for extra-uterine life. Previously the placenta has played the rôle of lungs, kidneys and intestinal tract and the vascular system has been adapted to this arrangement. The interruption of the placental circulation immediately creates a need for oxygen, and respiration must be induced to supply this demand through the lungs, while the call for nourishment and for the excretion of waste products must be met by the active functioning of the gastro-intestinal tract and of the kidneys.

Circulatory Changes.—The course and distribution of the blood is rapidly altered, as a result of the functioning of the lungs. Up to this time the pulmonary circulation has been relatively unimportant, and the greater part of the blood entering the right side of the heart has passed into the general circulation without going through the lungs. With the establishment of respiration and the consequent distention and aëration of the lung tissues, the foramen ovale between the right and left auricles is closed by the increasing pressure on the left side of the heart. As the blood entering the right auricle from the upper extremities and the head can no longer pass into the left auricle, it must pass into the right ventricle, whence it is propelled into the pulmonary circulation. At the same time, the ductus arteriosus becomes closed by the pressure of the adjacent aorta, so that all the blood in the pulmonary arteries goes to the lungs, where it receives oxygen from the inspired air and gives up carbon dioxid, thus realizing the adult mechanism of interchange.

Shortly after birth, the circulation through the umbilical arteries ceases, as is evidenced by the cessation of pulsation in the cord, and their lumina are obliterated by the contraction of the muscular walls. The continuations of these vessels within the abdomen, the hypogastric arteries, likewise become obliterated and eventually appear as rounded cords of fibrous tissue. On the other hand, the umbilical vein is occluded by a process of thrombosis and persists throughout the life as a fibrous cord, which in the adult is known as the round ligament of the liver. The ductus venosus becomes occluded and the blood from the intestinal tract is sent through the liver instead of being diverted into the inferior vena cava as it was before birth.

The Kidneys.—Children will frequently urinate immediately after birth, but there is no reason to believe that they do so before that time.

URINARY OUTPUT IN INFANTS (*Holt*)

	Cubic centimeters	Ounces
First twenty-four hours	0 to 60	0 to 2
Second twenty-four hours	10 to 90	⅓ to 3
Three to six days	90 to 250	3 to 8
Seven days to two months	150 to 400	5 to 13
Two months to six months	210 to 500	7 to 16

The kidneys seem to be prepared to function at an early period of intra-uterine life, but to require some special stimulus before actively beginning the secretion of urine. During early infancy considerable quantities of dilute urine are voided, and the preceding table gives the average daily quantity passed by healthy children at various ages.

The Digestive Tract.—As has previously been stated, the fetus may swallow small quantities of amniotic fluid *in utero,* but the digestive tract as a whole does not function until after birth. From the sixth month of development, the digestive glands are sufficiently developed to furnish the various digestive juices, which are, however, secreted only in the presence of ingested food. At first this function is quite imperfect; a fact which explains some of the difficulties encountered in feeding premature infants. A healthy full-term child is well equipped to digest breast milk or food of similar composition, but is not prepared to utilize the more concentrated and varied diet of the adult. Frequently meconium is discharged from the rectum soon after birth, although it is never passed *in utero* unless the fetus becomes badly asphyxiated.

Routine Physical Examination.—Shortly after birth the child should be submitted to a routine physical examination, wherein the general development of its body is noted and any visible congenital defects discovered. The total length from the crown of the head to the soles of the feet and the circumference of the head are important in the light of possible future developments, while for statistical purposes additional measurements are frequently made. The body is inspected for hare lip and cleft palate, spina bifida, abdominal tumors, hypospadias, club feet, paralysis of the extremities and fractures of the bones, while atresia of the anus is excluded by introducing the little finger into the rectum. The prompt recognition of existing abnormalities greatly increases the possibility of successful treatment.

The Umbilical Cord.—With the occlusion of the umbilical vessels after birth, the cord loses its circulation and rapidly becomes mummified. The accompanying illustrations, Figs. 90, 91, and 92, show how its stump shrinks and becomes converted into a blackened structure, while a sharp line of demarcation appears at its junction with the skin of the abdominal wall. Within a few days it sloughs off completely, leaving a small red granulating area which rapidly heals with the formation of the usual umbilical scar.

In the pre-antiseptic period, infections were not uncommon and resulted in the death of large numbers of infants during the first few weeks after birth. Since the recognition of this fact and the application

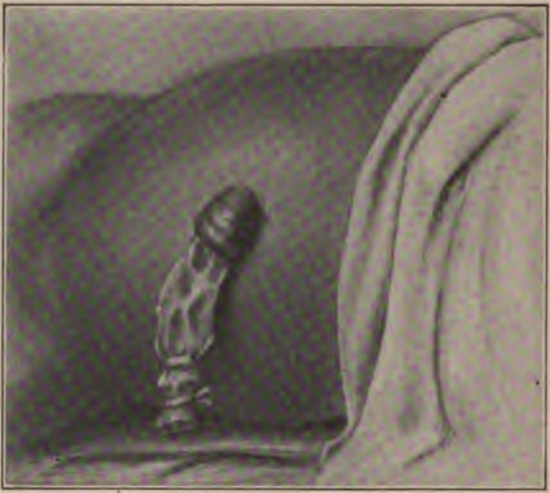


FIG. 90.—Umbilical cord twenty hours after birth.

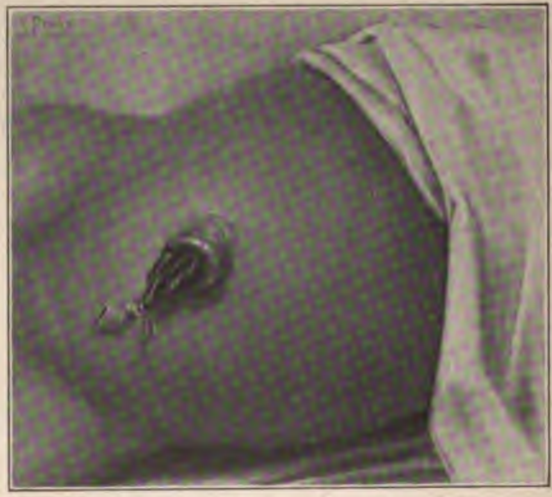


FIG. 91.—The same cord four days later.

of the principles of surgical cleanliness, fatalities from this cause have been comparatively rare.

The essential feature in the care of the cord is the avoidance of infection. The choice of a dressing is quite unimportant, provided the materials used are sterile and are sufficiently porous to admit air to facilitate desiccation. If a dry dressing is employed, it may be held in position by narrow strips of adhesive plaster, but with wet applications, such as alcohol, a wide flannel binder should be used. The dressings need not be disturbed unless they become soiled, when a new sponge should be applied in such a manner as to prevent contamination. After the cord has come off, a dry sterile gauze pad should be placed over the resulting granulating area until it is completely healed. Afterwards no further attention is necessary, and the flannel binder may be abandoned. The old idea that its use prevented the development of umbilical hernia is erroneous, as it tends to increase intra-abdominal pressure during crying and therefore may well encourage a hernial protrusion.

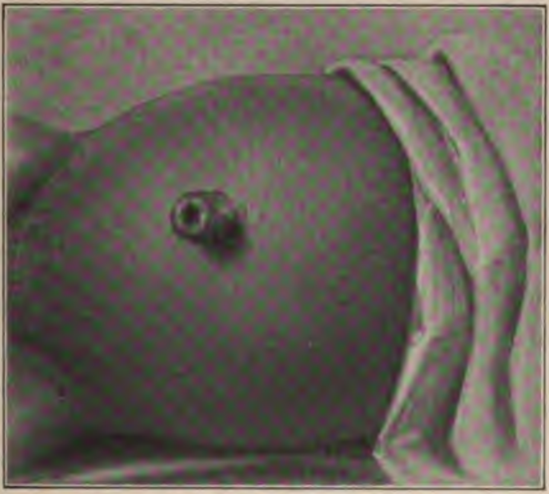


FIG. 92.—The same baby after separation of the cord.

Bathing the Child.—Immediately after birth the vernix caseosa should be removed as completely as possible by means of a non-irritating oil, such as albolene, olive oil, or benzoated lard, applied with a gauze sponge, the cord dressing not being disturbed. Further bathing is not necessary, and the flannel binder is applied and the child clothed in the usual garments. Each morning, until the cord is off and the scar healed, the entire body is rubbed gently with the same oil, special care being taken to cleanse the anal region, and after removing the excess with a soft cloth, clean clothing is put on. Consequently, a tub bath is not given for some days, but after the umbilical wound has become completely healed, it is repeated daily.

The prevalent routine of bathing newborn babies daily from birth with soap and water increases the probability of umbilical infection and has no reasonable support. Satisfactory cleanliness can be attained by the use of oil rubs and the child is not appreciably chilled during the manipulations. The procedure has long been advocated in the care of premature infants, because it tends to conserve the body heat, and the same argument supports the treatment in mature children. There is, moreover, a considerable saving of time.

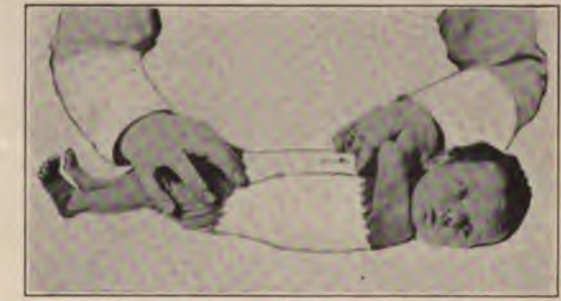


FIG. 93.—Applying a flannel binder.

Lap Baths.—If it is thought advisable to give soap and water baths before the umbilicus is healed, the lap bath should be employed, which does not endanger the sterility of the cord. For this purpose, the child is completely undressed and placed on a towel in the lap, while a second towel is used as a covering. The various parts of the body are then bathed in turn, while the remainder is protected. A soft washcloth is used with warm water (100° F.) and pure castile soap. Afterwards, the skin is thoroughly dried with a soft towel and a small amount of pure talcum powder sprinkled in the axillary and inguinal folds. The cord dressing should not be changed, unless it has become soiled.

Tub Baths.—After the umbilicus is thoroughly cicatrized, normal infants may be given a tub bath every day. The temperature of the water should be 95° to 100° F., during the first weeks, and gradually lowered as the child grows older. With the left hand behind the shoulders and the fingers in the left axilla, the nurse can support the head of the infant on her wrist while holding its body in the tub. Such a grasp is so secure that there is no danger that the child will slip out of control as a result of its movements. Most children soon learn to enjoy the bath and after a few weeks will kick and play about in the water. This should be encouraged, provided the time is reasonably restricted.

Baths of any sort should be given at the same time each day and the schedule should be so arranged that they come just before a feeding time, preferably immediately preceding the forenoon nursing.

Care of the Eyes.—The instillation into each eye immediately after birth of a solution of a silver preparation as a prophylactic against gonorrheal infection has already been mentioned. No further treatment of the eyes is necessary, unless abnormalities develop. Silver solutions, and more particularly silver nitrate, are occasionally followed by a purulent discharge within a few hours after their introduction. Bacteriologically, this exudate is sterile, does no harm to the eye and generally disappears spontaneously after two or three days. The pus should be frequently wiped away and the eyes may be gently irrigated with warm sterile salt solution or two per cent boric acid. The original Credé treatment with two per cent silver nitrate more frequently leads to the production of pus, and as it is no more efficient than the weaker solution, its use should be discontinued.

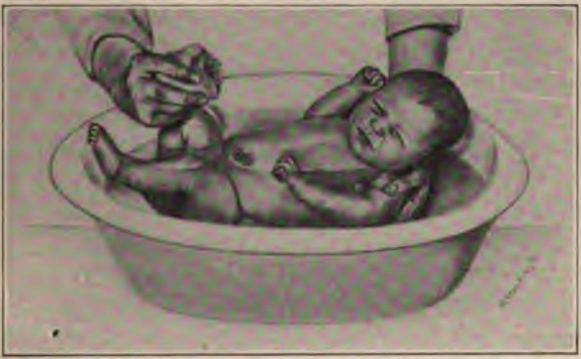


FIG. 94.—Proper manner of holding infant in bath tub.

The prophylactic treatment with silver nitrate solutions has reduced the frequency of gonorrheal ophthalmia to a fraction of one per cent in hospital practice, but does not destroy all bacteria, as purulent discharges caused by other organisms are frequently seen. As a precautionary measure, any pus formation in the eyes after the first twenty-four hours, during which the silver reaction may appear, should be considered of gonorrheal origin until it has been proved bacteriologically to be due to another organism. Consequently, the doctor should be notified at once, and the pus should not be removed until a smear has been taken for microscopical examination. All such cases must be strictly isolated and the nurse should carefully disinfect her hands after giving the child any attention in order to prevent the possibility of infecting her own eyes.

The benign infections frequently appear to be due to routine irrigation of the eyes, as they occur much less commonly in large nurseries if the practice is omitted. In some institutions the bath is regularly followed by flushing of the eyes with weak boric acid solution with the idea of diminishing the chance of infection. The facts, however, speak directly against this procedure, for experience has shown that if the eyes are not disturbed they are better able to resist the few bacteria which may be accidentally introduced.

Care of the Mouth, Nose and Ears.—The child's mouth normally needs no attention, and consequently there is no reason for cleaning it before and after feedings, as is frequently advocated. This procedure developed during the period of early antiseptic enthusiasm and is still employed in many places. In early infancy the mouth does not contain harmful bacteria, but there is considerable danger that they may be introduced during the frequent swabbings. Thrush, a common oral disease, has practically disappeared from nurseries where the practice has been discontinued.

The nose should likewise be let alone, unless there is a visible accumulation of desiccated secretion. This may be removed with a toothpick swab moistened with water or dipped in albolene. The same may be said regarding the ears. It is unwise to probe them for wax which is in the canal, although flakes protruding from the meatus may be gently removed with the finger.

The Bowels.—The lower intestinal tract contains at birth a considerable quantity of dark-brown or greenish-brown, tarlike material, known as *meconium*, which has accumulated during the latter half of intra-uterine life. This is expelled during the first few days of life and rapidly disappears with the appearance of milk in the breasts of the mother, to be replaced by the normal, yellow, homogeneous stools of infancy. The appearance of the bowel evacuations is of considerable importance in determining the condition of the child and the suitability of its food, and one of the napkins should be saved each day for inspection by the physician.

For the first two weeks there should be three to six stools daily, but after the first month the number is reduced to two to four. The frequency of bowel movements should be closely watched and if the normal impulse is not sufficient it must be encouraged. As a frequent cause of constipation is an insufficient fluid intake, the baby should be given a certain quantity of boiled water once or twice during the twenty-four hours. If this fails to cause regular and satisfactory evacuations recourse may be had to a soap stick or an enema. The former is simpler and better; a piece of ordinary laundry soap about two inches long is whittled down to the shape of a pointed lead pencil, and after being wet is introduced a short way into the rectum. It stimulates straining of the abdominal muscles, which usually results in a satisfactory movement.

For giving an enema, the child should be placed upon a table or held in the lap and turned upon its side. A small, soft rubber ear syringe, holding one to three ounces (30 to 90 cubic centimeters), is filled with soapy water, which is emptied into the rectum after the soft tip has been introduced beyond the sphincter. The fluid will soften the feces and at the same time stimulate their evacuation.

Neither of these measures should be used unless definitely needed, and after the administration of water has failed to produce the desired result. The habit of defecation twice daily should be cultivated and its establishment is highly desirable, as it will obviate considerable trouble later in infancy. Since the use of the soap stick more nearly simulates the normal impulse, it is to be preferred to the enema, which may well be held in reserve for times of special need.

Urination.—The child's kidneys are very active and the small capacity of the bladder necessitates frequent voiding. Very rarely so long a period as six hours will elapse between urinations, but a longer interval suggests insufficient fluid intake or an abnormality of the urinary tract. The child should be encouraged to void either before or after each feeding. Infrequent urination should be called to the attention of the physician. Pinkish or brownish deposits on the napkins are frequently due to an excess of urate crystals and have no significance.

The Diapers.—A generous supply of diapers made of a soft absorbent cloth should be provided, so that frequent changes may be possible. A suitable material (Bird's Eye Diaper Cloth) is on the market and is obtainable in various widths, either in the piece or already made up.

The most useful size is twenty-seven inches square. During the early months, the diapers are folded twice diagonally, while later only a single fold should be made and two diapers used each time. The child should never be permitted to wear wet diapers; they should be replaced as soon as they become soiled. After use they should be thoroughly washed with hot water and soap and care should be taken to rinse them free from soap, or otherwise the delicate skin may become irritated. Ironing is not necessary, but is desirable, while an occasional boiling helps to keep them spotless.

Icterus.—During the few days after birth the child frequently becomes jaundiced, with a visible yellowish discoloration of the skin and especially of the conjunctivae. This condition is due to the breaking down of large numbers of red blood cells in the body, and ordinarily has no clinical significance. At birth the number of red blood cells is normally very high, with a correspondingly increased hemoglobin content. Extra-uterine life does not demand this excess and, consequently, during the first week of life, nature effects a reduction and the broken-down blood pigment circulates through the body until finally excreted.

Vaginal Discharge.—Female infants occasionally develop a slight bloody vaginal discharge during the first week of life. It is obviously incorrect to call this precocious menstruation, since it occurs only once, and no further discharge appears until puberty inaugurates the normal menstrual flow. The actual cause is unknown, but in all probability the phenomenon is due to some substance derived from the maternal uterus, which is conveyed to the infant through the colostrum or milk. No treatment is necessary and all manipulations should be avoided, because of the danger of injuring the external genitalia and hymen. The usual standards of cleanliness are maintained with a soft cloth and albolene.

The Foreskin.—The foreskin of male children should receive attention during the first week of life. At each bath attempts should be made to retract it until the entire glans penis can be exposed. The smegma should then be gently washed away and a drop of albolene applied to the glans before the prepuce is again brought forward. When this is possible, it should be repeated daily for a week, or until no difficulty is encountered, but if at the end of seven days it is found impossible to effect complete retraction the physician's attention should be directed to the condition. When the difficulty is due to a true phimosis with an abnormally small preputial opening, which occurs in every fifth or sixth boy baby, circumcision will be necessary and should be performed during the first two weeks, when an anesthetic is not required. In the majority of cases, however, the release of adhesions between the glans and the prepuce will permit complete retraction and circumcision will be avoided.

It should be emphasized that, following retraction, the foreskin must be carefully returned to its original position. Failure to do this, particularly when the procedure has been at all difficult, may lead to the development of a *paraphimosis*. In this condition the foreskin, which has been retracted behind the glans, constricts the blood vessels of the latter and produces a localized edema, which, if neglected, may lead to gangrene of the end of the penis. If reasonable force will not return the glans through the ring of tissue, the physician should be called without delay. If he cannot replace the tissues manually, it may be necessary to incise the constricting band.

The Breasts.—Both male and female children occasionally exhibit a pronounced swelling of the breasts during the first two weeks of life, due to the ingestion, with the milk, of the same material which stimulates the mother's breasts. This condition of temporary activity is called *pseudo-lactation*. The glands become swollen and tense, the overlying skin is reddened, and there may be a slight secretion of "witch-milk" from the nipple. This fluid resembles colostrum in its appearance and chemical composition. The condition usually subsides without treatment within a few days. Massage is contra-indicated, and if any applications are made they should be sterile. The distention produces an area of lowered resistance, so that if pyogenic organisms gain entrance a real mastitis with pus formation may result. In such circumstances free incision and drainage becomes necessary.

Sleep.—For the first two or three days a healthy baby will sleep practically the entire time, and for the remainder of the first month from twenty to twenty-two hours each day. Hunger, pain and discomfort will alone cause him to awaken. As the child grows older, the wakeful periods will become more prolonged until at six months only about sixteen hours will be needed. It should be remembered that a healthy child, who is comfortable, warm, dry and well fed, will sleep of his own accord. Rocking a child to sleep is a pernicious, time-wasting practice which should be discouraged; for, after it has become a habit, great difficulty may be experienced in re-educating the child, so that if the infant is never thus spoiled the problem does not have to be faced.

Exercise.—Exercise is as essential for the infant as for the adult, and is obtained to the necessary extent by crying, kicking and waving the arms. The clothing should be loosely arranged so that free movement is possible, and occasionally the bed coverings may be removed to permit greater activity. After the first month these intervals should be prolonged and the baby encouraged to kick and stretch.

Crying.—Crying is necessary during the early days of life in order to insure thorough aëration of the lungs. For the first week it is important that a vigorous crying spell should occasionally be induced artificially, especially if there is a tendency toward too prolonged sleep. During the first six months fifteen minutes a day may be devoted to this form of exercise. A healthy child is never harmed by crying, and the end result is certainly better than if the over-indulgent mother or nurse goes to extremes to quiet the child.

Clothing.—The infant's clothing should be light, soft, warm, and only sufficient to insure proper warmth. The amount of clothing and especially of extra coverings should be varied with the temperature and care should be taken that the chest and abdomen are not constricted. One of the chief objections to the usual flannel band is that it may be unconsciously applied too tightly. After the cord has separated, the flannel band should be replaced by a knitted band with shoulder straps and a lower tab for fastening the diapers. The shirt should be wool or half wool and should have long sleeves and a high neck. Petticoats should all hang from the shoulders, being made of canton flannel for winter and cotton for summer. Outside dresses of cotton or linen are best. Nightgowns must be loose and warm, and after the first few weeks should have shirr-strings at the sleeve ends and at the bottom to prevent exposure when the child kicks. A "Baby Bunting" gown of heavy material is ideal for out-door naps and carriage rides during the cold weather. Whenever the child is taken from the crib or bassinet it should be wrapped in a thin woolen blanket. Scrupulous care must be exercised that the baby's clothes are kept clean.

Out-Door Air.—The old idea that out-door air is not good for young infants is being disproved every day. Even in winter, the windows of the sleeping room may be open at night practically from birth, the child being taken into a warm room for nursing and other attentions. Moreover, the morning and afternoon naps may be taken out-of-doors if the bassinet is well protected from the wind and the eyes shielded from strong sunlight, as it should be remembered that bright light causes actual pain to very young infants. Depending upon the prevailing temperature, the wraps should be increased or diminished, while in very cold weather a hot-water bottle at the feet may be necessary.

In cold climates during the winter season it is wise to accustom the newborn child more gradually to the outside air by graduated "indoor airings." The infant is clothed warmly and wrapped in extra blankets, while the windows of the nursery are widely opened, avoiding drafts. The procedure should be practiced once or twice daily and the length of the airings increased a few minutes each day, so that after a week or two the regular out-door periods may be begun. Very much the same method is employed in the case of premature babies after they have passed the period when continued heat is essential.

The Child's Weight.—In hospital practice the infant is generally weighed at birth and every succeeding morning at the time of the bath.

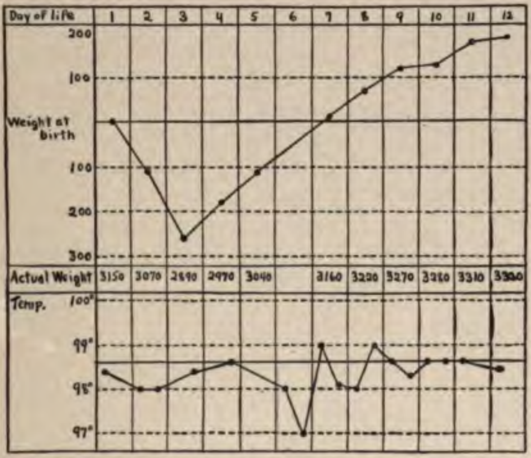


FIG. 95.—Normal weight and temperature chart for new-born baby—breast fed every four hours.

It should always be done at the same time of the day with the child entirely unclothed. This may well be continued for the first three or four weeks, after which weekly weighings are sufficient to indicate whether the gain in weight is satisfactory and consistent. Balance scales are far more accurate than the usual spring type and are recommended.

For the first three or four days of life the weight steadily falls, due to the lack of milk in the mother's breasts, as well as to the evacuation of large quantities of meconium and urine. The initial loss amounts approximately to one-tenth of the birth weight, and in general is greater in large babies and less in small ones. As soon as the milk supply becomes established the child ceases to lose and begins to gain, so that, by the tenth day, the birth weight has been regained. From then on, if the child receives sufficient food and digests it well, the gain should be steady, averaging four or five ounces (120 to 150 grams) per week, with the result that the birth weight is doubled in five or six months. Afterwards the gain is still more gradual and the birth weight is not trebled until the twelfth or fifteenth month. There is no better index of the child's well-being than a weight curve plotted from the weekly weighings.

Temperature, Pulse and Respirations.—For the first two weeks of life temperature and pulse observations should be made and recorded twice daily, but thereafter only when there is some reason to believe that the child is not well. The respiratory rate is of less value and need be counted only when the existence of some respiratory affection is suspected.

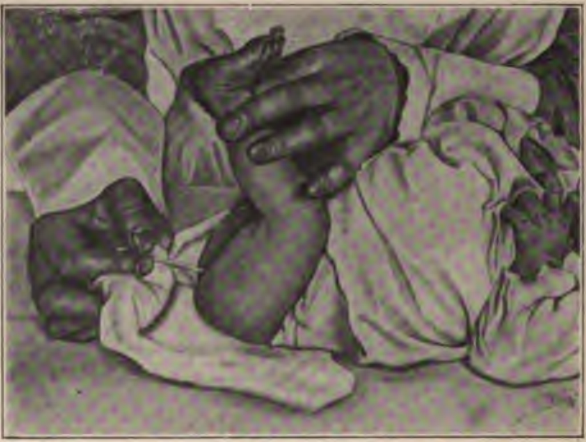


Fig. 96.—Taking an infant's temperature by rectum.

At birth, the child's temperature is practically that of its mother, but during the first few hours it may fall 1° to 3° F. (0.5 to 1.5° C.), and then rapidly rise to normal—98.5° to 99.5° F. (37° to 37.6° C.). It should be remembered that the heat regulation in infants is poorly developed, so that relatively slight disturbances may result in marked changes of body temperature, which for that reason are not as alarming as in adults. Sub-normal temperatures are frequently observed in weak and premature infants. Rectal temperatures are alone of any value.

The normal pulse rate is 120 to 150 per minute at birth and gradually becomes slower until at six months it will average 105 to 115 per minute.

Unusual rapidity may be due to a great variety of causes and therefore gives little definite information, whereas a slow pulse is very suggestive of a cranial injury sustained during birth.

The Nursery.—By preference a bright sunny room should be chosen for the nursery. It should be thoroughly screened against flies and other insects during the warm weather. An open fireplace has the great advantage of securing an adequate circulation of air without the production of drafts. During the first few weeks an attempt should be made to keep the temperature at about 72° F. (22° C.) during the day and 60° to 65° F. (15° to 18.2° C.) at night. The latter figure may be rapidly lowered and the child soon accustomed to the temperature prevailing when the windows are partly opened. In summer the temperature of the room should be kept as low as possible, and on excessively hot days the clothing should be reduced to shirt and diaper. The room should be darkened at the usual sleeping periods and at night no constant light is needed. Under no circumstances should empty bottles or soiled clothing be left in the nursery and it should not be used as a drying room after the daily washing. In institutions each baby should have a separate bassinet and overcrowding should be avoided.

Feedings.—The details of feeding are discussed in a later chapter, but it seems wise in this place to emphasize the need for mother's milk and to give certain general directions about nursing.

One of the most important considerations both in maternal and artificial feeding is the frequency with which food should be given. Above all things regularity is essential and when a schedule has been adopted nothing should be permitted to interfere with it. The present vogue is for relatively long intervals between the feedings, and the results obtained have been so satisfactory that a return to the two-hour schedule is hardly to be expected. With pediatricians recommending a four-hour interval for the children under their care, the more frequent feedings formerly given newborn infants are not necessary.

The baby should be put to the breast twelve hours after birth and every six hours thereafter until the milk appears. This is not done with the expectation that the child will obtain nutriment, as the breasts contain only a little colostrum, but for the purpose of accustoming the child and mother to the procedure and possibly of stimulating the early establishment of the lacteal secretion. When the milk flow has set in, healthy children should be placed upon a four-hour schedule with six feedings daily, say at 2:00, 6:00 and 10:00 A.M. and 2:00, 6:00 and 10:00 P.M., or at other more convenient hours. Children thus fed will ordinarily thrive better than those fed more frequently, and the longer interval of freedom is very acceptable to the busy nurse or mother. If, after a short trial, this arrangement fails to result in a satisfactory gain in weight, the number of feedings may be increased to seven with three-hour intervals during the day and every four hours at night, 2:00, 6:00, 9:00 and 12:00 A.M. and 3:00, 6:00 and 10:00 P.M.

While the mother is still in bed, nursing is most easily accomplished if she turns toward the breast to be used and the child is placed in the bed beside her. With one arm she can support its head and with the fingers of the opposite hand she can so depress the breast tissue in the neighborhood of the infant's nose that breathing is not interfered with. After she has left the bed, she may recline on a couch while suckling. Otherwise, it will be most convenient for her to sit in a low chair and hold the infant in the arm corresponding to the breast to be used. The essential thing is that the mother be comfortable, for if nursing is really a pleasure to her there will be no difficulty in persuading her to continue it until the proper time comes for weaning.

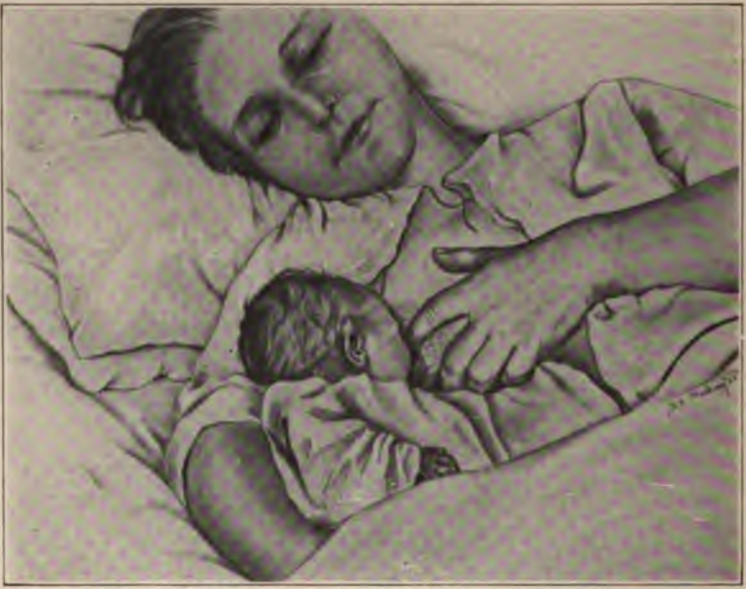


FIG. 97.—Position for nursing while the mother is in bed.

The idea that the nipples and areolae should be cleansed before and after each nursing is quite universal, but there is no reason to suppose that the various antiseptic solutions employed have any special virtue. Consequently, it is quite sufficient if they are washed with warm boiled water just before the child suckles, while more thorough cleansing with soap should be part of the daily bath. The application of a square of sterile gauze between sucklings tends to eliminate undue contamination.

With the suckling reflex so strongly developed at birth, it is rather rare that difficulty is experienced in persuading the child to nurse, if the nipples are well developed. Occasionally, however, considerable patience must be exercised for a few days until a proper habit is formed. In many instances the expression of a drop of milk from the nipple will encourage the child to take hold, and a few more drops squeezed into its mouth will be all that is needed. When a baby does not suckle well, the nipples must be carefully examined to see that they protrude properly under stimulation. If no physical cause for the disability can be discovered, persistent and conscientious efforts will usually be rewarded. For this reason the mother should not be discouraged and should not admit failure for some weeks. During this period the nutrition of the

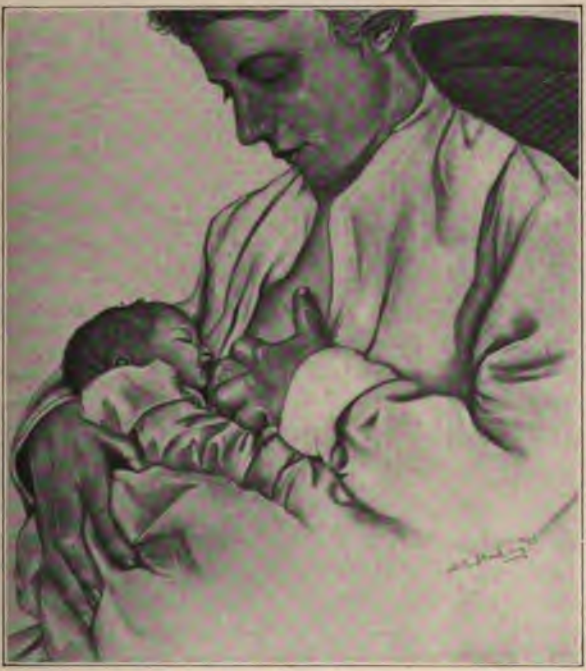


FIG. 98.—Position for nursing when the mother can sit in a chair.

child should be maintained by milk which has been expressed from her breasts or by formula feedings administered subsequently to the attempts at nursing.

Formula Feeding.—Artificial feeding entails a considerable amount of attention to details and is far more time-consuming than maternal nursing. In making the prescribed formulae all possible sources of contamination must be avoided. The glassware should be thoroughly washed and then boiled for five minutes before the preparation is begun. After the milk has been diluted with water and the added sugar dissolved, the mixture should be quickly heated to boiling and immediately placed in the regular nursing bottles, which are closed with cotton plugs and put on ice. A full day's supply is made up at one time, and it is always wise to prepare at least one extra bottle against possible accidents. The milk for each bottle should be measured with a reasonably accurate graduate because the marks on the bottles themselves are frequently far from correct. The usual round bottles with small necks are to be preferred, as they are not only less expensive, but can readily be transported, upon occasion, by the simple expedient of stoppering with a cork.

The usual nipples of black rubber have several disadvantages: they deteriorate rapidly with frequent boiling and even more quickly lose their elasticity, so that they collapse in the baby's mouth, thus preventing the ingress of air which is necessary to the maintenance of a steady outward flow of the milk. There is, however, on the market a superior nipple, made of transparent rubber similar to that used in thin rubber gloves, with a reinforced tip, which has no tendency to collapse and withstands sterilization very effectively.

All nipples should be washed thoroughly after using, boiled for five minutes, and kept until required in a covered vessel under boiled water. It is essential that the holes at the tip be of correct size; if too small, the feeding is unduly prolonged and the child may become exhausted before it is finished, while, if too large, the stream of milk may induce coughing or vomiting. When they are of the proper size, the milk should form a drop outside the nipple when the bottle is inverted, or may even drop at the rate of a drop or two each second.

Feeding an infant should be made a business rather than an incident as so frequently happens. The bottle and milk should be warmed to 100° to 105° F. before being offered, and, by spurting a few drops on the flexor surface of the wrist, not only can its temperature be roughly estimated, but the patency of the nipple determined. Thermos bottles may be used to keep the night feeding warm until it is needed, but especial care must be taken to have it and the milk sterile, for otherwise bacterial growth may be greatly accelerated. The bottle should be held at such an angle that its neck is completely filled with milk. A succession of air bubbles through the liquid indicates that the flow is continuing, while the absence of bubbles shows that the nipple has collapsed or that the hole has become occluded. One should not insist that the baby take the entire allowance, as his appetite is the best index of his needs.

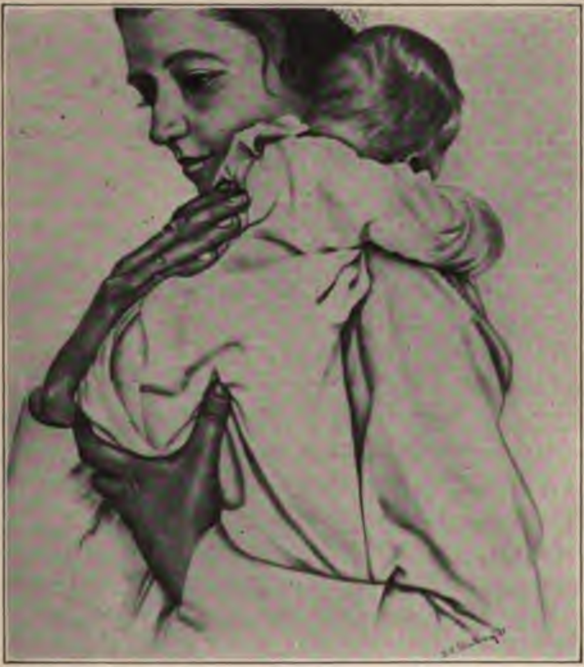


FIG. 99.—Manner of holding an infant after nursing to permit the escape of stomach gas.

Stomach Gas.—After each feeding, whether maternal or artificial, the infant should be held upright against the shoulder for a few minutes to encourage the expulsion of the small quantity of gas which is always present in the stomach at that time. Gently rubbing the back will sometimes be of assistance. Attention to this detail may prevent colic which is so annoying in young children, and promptly cure many cases of vomiting.

Growth of the Infant.—The human infant develops very slowly in comparison with the lower animals. At five months its birth weight has only doubled and it has increased but five inches in height. The elongated shape of the head of the newborn usually disappears within a few weeks. The cranial sutures close shortly after six months, the posterior fontanelle at two months, and the anterior fontanelle only after a year and a half. Voluntary movements are first made during the fourth month, and at about the same time the child becomes able to hold its head erect. At eleven months it can stand with assistance, and a month or two later will begin to walk. Within two weeks after birth an infant follows a light with its eyes, but the actual recognition of persons and objects does not occur until the fourth or fifth month. Hearing develops during the first two weeks, after the eustachian tube has opened and admitted air into the middle ear, but the child will not turn its head toward the point from which the sound comes for two or three months. Actual recognition of voices is uncommon prior to the fourth or fifth month. Speech begins only at the end of a year or more, although purposeful sounds of a coaxing or scolding nature are common after three or four months and largely replace the earlier indiscriminate crying. After three or four weeks an occasional smile is noticed and at two or three months the child will laugh aloud. The first teeth—the lower central incisors—usually appear at the age of six or seven months; the others follow slowly and it is not until two and a half years that the full set of twenty "milk teeth" are in evidence. Saliva is present only in very small quantities until the fourth or fifth month, when the glands become more active. For some time the child has difficulty in swallowing it as rapidly as it is secreted and "drooling" is common.

Infant Training.—The keynote of success in the raising of children is *regularity,* and training toward this end should begin at birth. Habits are very easily formed by an infant and care should be exercised that only those are developed which will simplify its care and not interfere with normal growth.

Perhaps the most important habit has to do with feeding. A schedule should be adopted and adhered to; the infant should not be fed until the proper time even if it does cry, nor should the feeding be postponed because it is asleep. This may at first entail some mental suffering on the part of the mother, but after a few weeks the child's demands will cease to disturb the ordinary routine of the household, when the wisdom of such discipline will be apparent. The only exception to this rule is in connection with the 2:00 A.M. feeding, as the child should be fed only when it awakens, and as it grows older it will sleep longer, so that in a few months, this feeding can be omitted.

Sleep can likewise be regulated at an early age. The child should have a separate bassinet or crib and should not occupy the mother's bed. No special efforts are necessary to induce sleep, and rocking and walking the baby to sleep can only be condemned. When it has been fed and given a dry diaper it should be placed immediately in the bassinet, the room darkened and loud noises excluded. Sleep will come after a longer or shorter crying spell and within a few weeks the routine may be maintained without difficulty. After the first month of life, infants do not sleep as deeply as older children, so that bright lights and noises should be prohibited in the nursery. A night light is not needed and many future complications may be avoided by accustoming the child to the darkness.

Many children are likewise susceptible to early training in regularity of urination and defecation. During the first few weeks a dry diaper should be applied before each nursing and at a later period the child should be supported on a small chamber. At first little success may follow such procedures but by persistence a fixed habit can be formed. Sometimes babies spontaneously acquire a definite time for defecation, and by encouraging this natural tendency the function may easily be regulated.

Sucking should not be encouraged in the intervals between feedings and modern authorities are unanimous against the use of the "pacifier" and similar devices, as they develop persistent habits which later prove annoying.

As the child grows older and the waking periods are longer, the same regularity should be enforced and definite hours scheduled for play and for morning and afternoon naps.

The following schedule is well adapted to the routine of the average household, but in individual cases may need to be varied by reason of special circumstances:

6:00 A.M.	Feed.
9:30 A.M.	Bathe, dry carefully, powder, clean nose and dress in clean clothes.
10:00 A.M.	Feed.
10:30 to 12:30	Out of doors.
2:00 P.M.	Feed
2:30 to 4:30 P. M.	Out of doors.
6:00 P.M.	Change to night clothes and feed.
	The diapers are to be changed before each feeding and at other times, when necessary.

Unless engaged for longer than the usual period, the obstetrical nurse can only begin this training, which, however, is an important part of her duty. She should initiate the proper system and give advice concerning future training. Frequently she can do great good by imbuing the mother with ideas as to the benefits of such training by illustrations drawn from her own experience.

CHAPTER XI

DISEASES AND ABNORMALITIES OF THE OVUM AND FETUS

Diseases of the Ovum.—During the early stages of development, numerous more or less serious variations from normal may affect the entire ovum or any of its parts. Abnormalities may develop at any time during intra-uterine life, but practically all serious developmental abnormalities or monstrosities originate during the first days of pregnancy. The immediate fate of abnormal ova depends upon whether the changes are consistent with continued intra-uterine life. If they are, the pregnancy proceeds undisturbed and postnatal development will continue, unless the lesions are incompatible with a separate existence; but if they are not, the ovum perishes *in utero* and is usually promptly expelled, thus explaining the production of many abortions and miscarriages.

We shall consider in order the diseases and abnormalities of the chorion, amnion and placenta, then those affecting the entire ovum, and lastly those in which the fetus alone is implicated.

DISEASES OF THE CHORION

Hydatidiform Mole (Vesicular mole).—Hydatidiform mole is a condition in which the chorionic villi are converted into transparent, grape-like vesicles with clear fluid contents. As the disease usually makes its appearance in the early months of pregnancy, the entire periphery of the ovum is affected. By reference to the accompanying illustration it will be seen that the vesicles vary in size from minute bodies to cystic structures a centimeter or more in diameter, which completely fill the uterine cavity. In the interior of the vesicular mass the collapsed amniotic cavity is frequently present, but there is rarely any trace of the fetus. In microscopic preparations the exterior of the vesicles is characterized by a profuse growth of the chorionic epithelium, while the interior is filled with mucoid tissue or by large spaces filled with fluid but devoid of cells.

In some respects the condition is similar to that observed in chorio-epithelioma, which frequently develops subsequently to the expulsion of a hydatidiform mole, although, even in such cases, the most careful examination fails to differentiate between a benign and a malignant type of mole.

Frequently the ovaries become converted into polycystic masses 10 to 15 centimeters (4 to 6 inches) in diameter, the individual cysts containing clear fluid and being lined by typical lutein cells. These *lutein cystomata* are benign tumors, which usually undergo complete involution following the expulsion or removal of the mole.

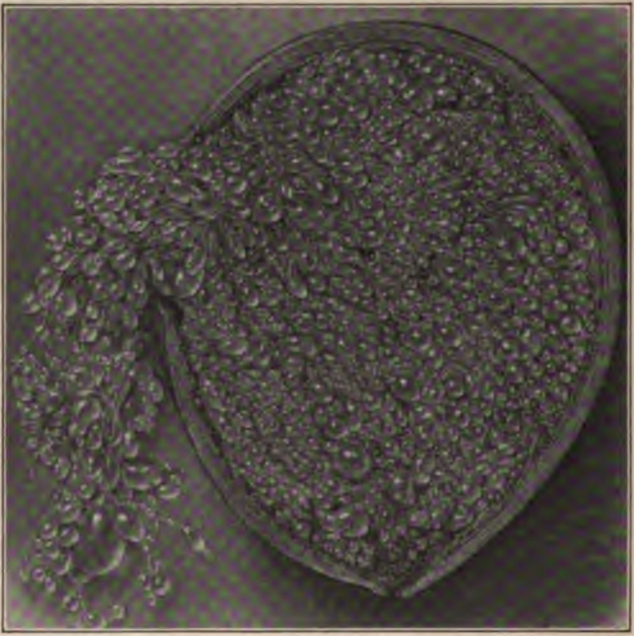


FIG. 100.—Uterus containing hydatidiform mole. (Williams.)

The actual cause of the condition is unknown, but the most plausible theory connects it with an early interference with the nourishment of the growing product of conception. As clinical observation shows that the uterus is enlarged out of proportion to the supposed duration of pregnancy, it is evident that the change must have originated shortly after fertilization occurred. Moreover, the complete absence of the fetus in most specimens leads to the conclusion that it must have perished and been absorbed at an early age, as such absorption could not have occurred after bone development had commenced.

Hydatidiform mole is a rare complication, occurring only once in several thousand pregnancies, and generally in patients between the ages of twenty and thirty years. It is, however, not uncommon after the fortieth year, so that, considering the relative infrequency of pregnancy at that age, its incidence would seem to increase as the menopause is approached.

Signs and Symptoms.—The occurrence of a more or less profuse hemorrhage is frequently the first evidence that the existing pregnancy is not normal. Usually the first suspicion of the existence of the complication is afforded by a lack of correspondence between the menstrual history and the size of the uterus. For example, the former may indicate a two or three months' gestation, whereas examination shows the uterus extending above the umbilicus, in other words the size of a five or six months' pregnancy. In more advanced cases the fetal heart cannot be heard, nor can fetal movements be perceived. A positive diagnosis can only be made by finding typical vesicles in the bloody discharge or by palpating the grapelike masses with the finger through the cervix.

Treatment.—After the diagnosis has been made, the uterus should be immediately emptied. The cervix is dilated by appropriate means sufficiently to admit two fingers and the growth gently peeled from the uterine wall with the fingers and removed with placental forceps. Following the removal, a hot intra-uterine douche of sterile water is given, and the uterine cavity is packed with a loose gauze pack, which is removed twelve hours later. The uterine wall is frequently so weakened by the invasion of the fetal cells that instrumental curettage is contraindicated on account of the danger of perforation.

The nursing after-care is that of any other completed abortion. For some months after the expulsion of a mole, the patient should be closely watched, and the occurrence of any unusual bleeding should lead to prompt curettage for the purpose of detecting the early stages of a chorio-epithelioma, should that tumor develop.

Prognosis.—The immediate mortality is not high, but death may result from uncontrolled hemorrhage, infection, or perforation of the uterus. Even if there appears to be no complication, the possibility still remains that chorio-epithelioma may later supervene and require radical surgical interference.

Chorio-Epithelioma (Deciduoma malignum).—Occasionally, the epithelial elements of the chorion become malignant and give rise to a rapidly growing tumor known as chorio-epithelioma. As such tumors have their origin in the trophoblastic cells of the developing ovum they can only appear in connection with gestation, and may follow full-term delivery, abortion, extra-uterine pregnancy, or hydatidiform mole. About one-half of the reported cases have been preceded by the last-named complication. The tumor is one of the most malignant known to the pathologist and may lead to death within a few months. Fortunately it is very rare and does not occur more than once in 10,000 to 20,000 pregnancies.

As the trophoblastic cells take on malignant properties they suddenly begin to grow more profusely and become very invasive, overpowering the defensive mechanism of the decidua, and growing out into the muscle tissue. Near-by blood vessels are opened up and small masses of the cells gain access to the vessels and are transported to various organs, where they give rise to metastases, especially in the lungs, vagina, kidney, spleen and ovary. In a certain proportion of the cases, lutein cystomata similar to those associated with hydatidiform mole develop in the ovaries.

It is evident that close relationship exists between these two processes, but no definite statement can be made concerning its nature.

Clinical History.—In more than half the cases the first sign of the disease is the appearance of vaginal or vulval metastases. More rarely an abnormal menstrual flow or hemorrhage following a hydatidiform mole or even an abortion or spontaneous delivery may indicate a curettage, when microscopic examination of the tissues removed may reveal the characteristic lesions. Cough and bloody expectoration usually indicate the development of metastases in the lungs.

Treatment.—In general, the only hope for successful treatment is early diagnosis followed by complete removal of the uterus, tubes, ovaries and upper portion of the vagina. The presence of metastases in the lungs or other organs indicates that the patient is beyond surgical aid, but fortunately experience has shown that vaginal metastases do not involve so grave a prognosis, and instances have been reported in which their removal in the absence of a uterine tumor has been followed by permanent recovery.

DISEASES OF THE AMNION

The amount of amniotic fluid may be either excessive (*hydramnios*) or much below normal (*oligohydramnios*). These conditions will be considered, but other minor abnormalities of the amnion will be omitted.

Hydramnios (dropsy of the amnion).—This term indicates the presence of an excessive quantity of amniotic fluid—more than two liters. Five or six liters are not uncommon, while in rare instances there may be as much as fifteen or even thirty liters. Usually the accumulation of fluid is gradual, but occasionally immense quantities may be formed within a few days—*acute hydramnios.* In either case there is no difference between the fluid and normal amniotic fluid. As the origin of the latter is still uncertain, little can be said concerning the etiology of hydramnios, but it is known that abnormalities of the fetus as well as certain diseases of the mother predispose to it. Thus, spina bifida, ectopia of the bladder, abnormalities of the heart, and similar malformations are frequently found in the former, while the latter may have cardiac or renal disease. It seems that such relationships must be more than incidental, but their inconstancy renders accurate statements impossible.

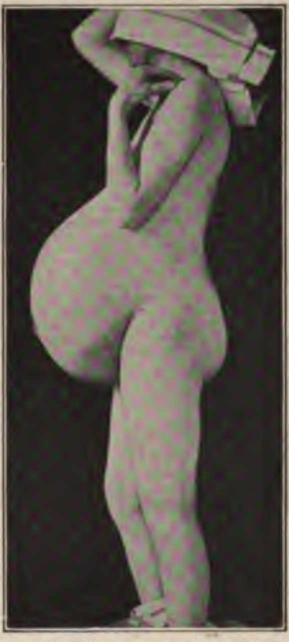


Fig. 101.—Unusual distention of abdomen due to hydramnios. (Williams.)

Diagnosis. — The condition is always suspected when an unusually large and tense, fluctuating tumor replaces the normal pregnant uterus. The percussion note is not tympanitic at the apex of the enlargement as in ascites, but uniformly dull. It is difficult to outline the fetus, but the head and extremities can frequently be ballotted; although the fetal heart is heard with difficulty even if the child is alive. The differential diagnosis between hydramnios and multiple pregnancy or an ovarian cyst complicating a normal pregnancy is at times very difficult.

Treatment.—The milder grades of hydramnios only develop late in pregnancy and rarely require treatment. If, however, the distention is sudden, it may so seriously interfere with respiration that the interruption of the pregnancy is indicated irrespective of the stage of development of the child. This is not so radical a decision as appears at first glance, as the child will surely die if the process continues unchecked, so that interference really offers its only chance.

In order to terminate the pregnancy, it is generally only necessary to rupture the membranes by introducing a pointed instrument through the cervix. Large quantities of fluid immediately escape and the distress of the patient is relieved. Labor pains usually set in within a few hours and continue until delivery is affected. The loss of tone of the uterine muscles incident to the prolonged distention may considerably prolong labor, as well as the placental period, which is accompanied by an increased likelihood of serious atonic bleeding. For this reason the condition of the uterus should be watched very closely for several hours after delivery.

Oligohydramnios.—The etiology of this rare complication is very obscure, and the diagnosis is usually made only after the conclusion of labor when the existence of abnormalities on the part of the fetus suggests its presence. It has been observed in cases where the fetal kidneys were congenitally absent or the urethra imperforate, but that it cannot be entirely attributed to defective urinary secretion is shown by the fact that it sometimes occurs when the urinary organs are normal.

When the condition is present in early pregnancy, it predisposes to the formation of amniotic adhesions, while in the later months it may be responsible for such deformities as club-feet.

There is no recognized treatment, as there is no known method of relieving the condition, even if it could be diagnosed during pregnancy, while the difficulties attending delivery are met as they arise in individual patients.

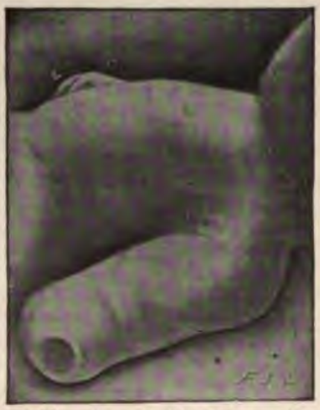


FIG. 102.—Amputation of arm by amniotic adhesions. (Williams.)

Amniotic Adhesions. — Adhesions may form between the amnion and the skin surface of the fetus and give rise to marked deformities. Although they are more frequent when the amount of amniotic fluid is abnormally small, they may develop when it is normal.

As the uterus enlarges, such adhesions may exert considerable traction, which results in malformation of the part of the fetus involved; thus, there may be fissures of the cranium or of the thorax, or the amniotic bands may constrict an extremity and lead to its amputation (Fig. 102). In very rare instances strong, broad adhesions between the fetus and the interior of the uterus have caused great difficulty during delivery.

ABNORMALITIES AND DISEASES OF THE PLACENTA

Variations in Size and Shape.—In the early months of pregnancy the placenta weighs more than the fetus, but shortly before the middle of the gestation period this relationship is reversed and at full term the normal placenta weighs only one-sixth as much as the child. Relatively large placentae are almost characteristic of syphilis, but may sometimes be associated with chronic nephritis; while in general edema of the fetus and placenta the latter may even exceed the former in weight.

As a result of a defective blood supply in the decidua, the formation of the normal, circular or oval placenta may be interfered with and certain abnormalities develop. In the most extreme case, the villi persist over the entire periphery of the ovum, so that a thin placenta is attached to the entire interior of the uterus—*placenta membranacea* or *diffusa.* Marked examples of this condition are rare, but it is not uncommon to see a very large thin placenta, which approaches the membranaceous type. The ovum receives sufficient nourishment and attains full size, but during the third stage of labor the separation of the placenta is difficult, and bleeding may be so profuse that manual removal is necessary to save the patient.

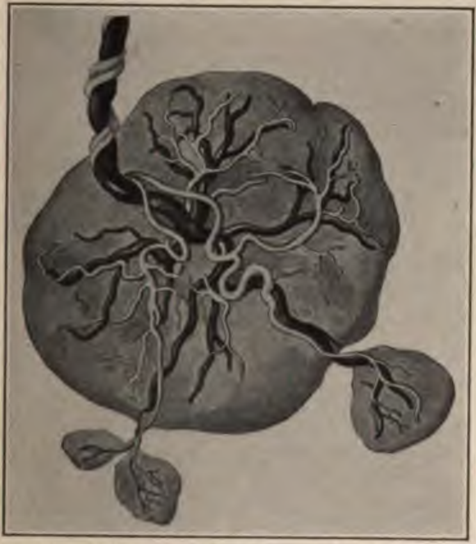


FIG. 103.—Placenta with three succenturiate lobes. (Bumm.)

More frequently the placenta develops in two or more distinct parts, the outlying lobe or lobes being connected with the main organ by branches of the umbilical vessels—*placenta duplex, triplex,* etc. If the portions are not completely separated and the vessels cross from one to another, the terms employed are *placenta bipartita, tripartita,* etc. Quite frequently small accessory lobules of placental tissue develop some distance from the main placenta, with which they are connected by blood vessels passing through the membranes—*placenta succenturiata.* In this condition there is considerable danger that the detached lobes may be retained after the placenta has been expelled and cause hemorrhage. Careful examinations of the membranes will show a small defect corresponding to the missing lobule and the diagnosis is made absolute by the detection of vessels leading from the main placenta to the edge of the tear and ending abruptly with torn ends. In such circumstances the physician must remove the retained lobule manually.

White Infarcts.—In practically every placenta dull white areas of varying size and hard to the touch are scattered through its substance—*white infarcts.* They may occur in any part of the organ, but are more common on its fetal surface, just beneath the amnion. Occasionally a whole cotyledon may be involved, or the process may give rise to a broad band at the periphery of the placenta where the membranes are attached—*placenta marginata.* White infarcts result from a gradual obliteration of the blood vessels, and are consequently regarded as evidence of senility in the placenta. They may appear early in pregnancy, but rarely become large until near its end. In general they are without significance, but occasionally they involve so great a part of the placenta that the fetus perishes from lack of nourishment.

Red Infarcts.—More rarely, rounded or oval, brick-red areas are present in the placental substance, especially near its maternal surface—*red infarcts.* Their etiology is unknown, but, as the changes are more commonly observed when the mother is suffering from chronic nephritis, some definite relationship is supposed to exist between the two conditions. If any considerable area of the placenta is involved the child is poorly developed or may die *in utero.*

Cysts and Other Tumors of the Placenta.—These are occasionally seen, but have no great practical significance.

Placentitis.—When intra-partum infection of the uterus occurs from careless vaginal examinations, prolonged dry labor, or an exacerbation of an old gonorrheal endometritis, the placenta may be involved in the inflammatory process, and the organisms concerned can frequently be demonstrated microscopically in its tissue. The condition is called *placentitis.* Clinically, the possibility of this complication should be considered whenever, during the course of labor, a patient develops a temperature of 101° F. (38.3° C.), or a pulse rate of more than 120 per minute. The maternal puerperal morbidity and mortality are somewhat increased, but the effect upon the child is more striking, as the infecting organisms may gain access to the fetal circulation through the umbilical vessels, with a resulting septicemia which may kill the child before birth or cause its death during the first few days of extra-uterine life. Placentitis therefore ranks as an important cause of fetal mortality.

Calcareous Deposits in the Placenta.—Quite frequently the maternal surface of the placenta is studded with numerous small white masses of the size and consistency of coarse sand. Such areas represent deposits of lime salts and are more commonly seen in mature placentae. They may be due to senility of the organ, but are without practical significance.

Adherent Placenta.—Although, in the condition commonly designated as "adherent placenta," the organ is not actually adherent, in rare instances the chorionic villi extend through the decidua, make their way between the muscle fibers, and so anchor the organ to the uterine wall that the normal process of separation is out of the question, and manual removal can only be effected by tearing through the placental tissue. Consequently, considerable portions are retained, so that such patients usually die from hemorrhage unless the condition is appreciated and hysterectomy performed. Difficulty in expressing the placenta, however, is usually the result of anomalies of contraction on the part of the uterine muscle and can be successfully treated by measures to be described later.

ABNORMALITIES OF THE UMBILICAL CORD

Variations in Insertion and Length.—In every fifth placenta the cord is inserted practically at the center, whereas in the remainder it is attached eccentrically. When the junction is directly at the margin, the term *battledore placenta* is employed. Such variations of insertion are of no moment.

Once or twice in a hundred placentae the cord terminates in the membranes at some distance from the placental margin and the vessels pass to it through the membranes—*velamentous insertion of the cord.* This abnormality is of no importance unless one of the vessels extends across the internal os, where it may be torn through when the membranes rupture—*vasa previa.* In this event the fetus perishes from loss of blood.

Abnormally Short Cords.—In the rare instances in which the cord measures 25 centimeters (10 inches) or less in length, it is absolutely too short, while relative shortness due to a cord of normal length being twisted around the child's neck or extremities is more common. Unless the absolute or relative shortening is so great as to prevent the expulsion of the child as far as the umbilicus it does no harm, as in such cases delivery can be completed after clamping and cutting the cord. The more extreme cases are rarely recognized until forcible attempts at delivery result in rupture of the cord, separation of the placenta, or even in inversion of the uterus.

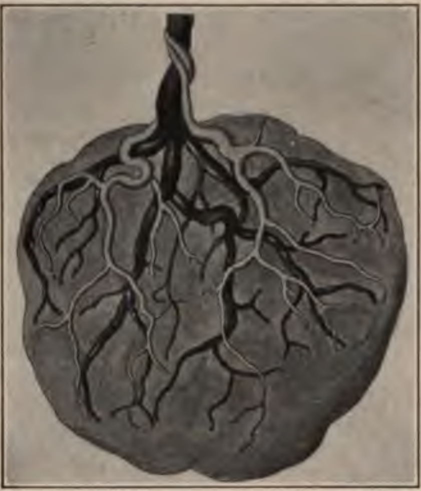


Fig. 104.—Battledore placenta. (Bumm.)

Unusually Long Cords.—Cords more than 100 centimeters (40 inches) in length are not common and rarely cause difficulty, although they may be wrapped many times about the neck and limbs, and have a tendency to prolapse during labor.

Other Abnormalities.—*False knots* due to abnormal development of the cord are common, but *true knots* resulting from the activity of the fetus, as favored by hydramnios in the presence of a long cord, are less frequent. The former is without practical significance, whereas the latter may cause the death of the child should the knot become taut. *Loops of cord* about the neck or extremities are frequently seen, but rarely cause trouble, although occasionally a fetal death may be attributed to strangulation by an unusually tight loop encircling the neck.

DISEASES OF THE FETUS

Syphilis.—Among patients of the lower classes syphilis ranks as the most important cause of fetal death during the last three months of pregnancy and is responsible for many fatalities during the early weeks of extra-uterine life. It is doubtful whether early abortions are ever due to this disease, since it is very rare to find any evidence of syphilis in fetuses of less than four months' development.

In general, infection of the product of conception undoubtedly occurs from the presence of the specific Treponema pallidum in the mother, although paternal infection by way of the spermatozoa cannot be entirely disregarded. This latter hypothesis has been used to explain the fact that women presenting no signs of syphilis may give birth to children with definitely syphilitic lesions, and cannot be infected by them, while normal women are (*Colles Law*). As it has been shown that such mothers have a positive Wassermann reaction, the validity of the "law" has been seriously questioned by many writers. At present, while it cannot be said definitely that the father may infect his offspring without infecting the mother, there is considerable clinical evidence in support of the view.

In the majority of cases the infected fetus dies before maturity is attained and is soon expelled from the uterine cavity. If the expulsion is delayed more than a few days the fetal tissues undergo *maceration*—that is, the skin becomes discolored and peels off, exposing the dark red subcutaneous tissues, the skull bones become so loosened that the head becomes soft and shapeless, while the internal organs lose their characteristic structure and are converted into a pultaceous mass. Maceration is not pathognomonic of syphilis, but may follow death of the fetus from any cause. Nevertheless recent investigation has shown that seventy to eighty per cent of all macerated fetuses are syphilitic.

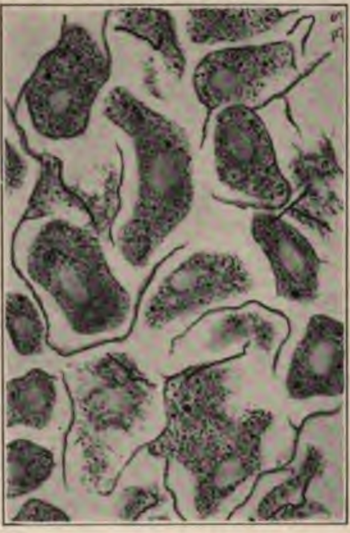


FIG. 105.—Treponemata pallida in liver of syphilitic child.

The pathological changes in the syphilitic child are widespread and involve most of the organs, indicating that it must have suffered from a treponemal septicemia. The liver, lungs, adrenals and long bones are so characteristically altered that the pathologist is able to make a diagnosis from their examination. Moreover, as the bone changes can be demonstrated by means of the X-ray, that method of diagnosis is applicable to the living child as well. By suitable staining methods the treponemata can be demonstrated in the tissues in enormous numbers.

Placental Syphilis.—Fetal syphilis is commonly associated with characteristic lesions in the placenta, which is large in size and presents a pale, greasy appearance. Instead of weighing one-sixth as much as the child, the ratio may increase to one to three, while in extreme cases the placental weight may equal that of the child. Under the microscope it will be seen that the change is due to the fact that the individual villi are considerably larger than normal and the blood vessels are in great part obliterated, while the stroma cells are much more abundant and closely packed. It is difficult to demonstrate the presence of the treponemata, but occasionally they may be found in the walls of the vessels. Such changes indicate that a large part of the blood going to the placenta is utilized for its growth instead of for the nutriment of the child. Consequently, it is probable that intra-uterine death of the fetus results partly from this cause and partly from the septicemia from which it suffers.

The umbilical cord is likewise infected, but its lesions are not so constant or so characteristic as are those in the placenta. Clinically, syphilis of the cord is of some importance because it may render its tissues so friable that they are severed upon applying a ligature. In such cases the children ordinarily succumb within a few days, even though hemorrhage from the cord can be avoided by some expedient.

Dropsy of the Fetus.—In this rare condition, the fetus and the placenta are markedly edematous and weigh more than they should for the period of development. It is not associated with edema of the mother, but rather with abnormalities of the fetus itself. The child always dies *in utero* or survives its birth by only a few hours.

Fetal Intoxications.—In addition to the more or less mechanical causes of death included under the general term asphyxiation, the fetus sometimes succumbs to the action of various toxins elaborated in its own body or transmitted to it through the maternal blood. The effects of fetal syphilis have already been noted as representing an important group of auto-intoxications. Various other diseases of the mother may place the child's life in jeopardy; chief among them are eclampsia, chronic nephritis, decompensated cardiac disease, the various acute infectious diseases, such as typhoid fever, pneumonia and influenza, and chronic poisoning with lead and phosphorus. High fever, due to whatever cause, always affects the fetus, and, if long continued, will eventually lead to its death. The serious condition of the mother in these complications ordinarily precludes any special effort in the child's behalf.

Abnormal Growth and Development of the Fetus.—Excessive size of the normally developed fetus is not unusual, while the abnormalities or malformations which occasionally occur are so manifold that it will be possible to mention here only a few of the more common examples. For information concerning the rarer conditions the reader is referred to the works devoted especially to embryology and teratology.

Excessive Development.—Exceptionally the fetus may undergo unusual development *in utero,* but be normal in all other respects. The most frequent etiological factors concerned are: unusually large size of one or both parents, prolongation of pregnancy, and, occasionally, advancing age or multiparity of the mother. Unless the child weighs more than 4500 grams (10 pounds) at birth it is not considered oversize, for below this limit its bulk alone rarely interferes with the course of labor if the mother's pelvis is normal. Above this limit, however, the large size of the child may give rise to serious dystocia. Fortunately, the size of the child's head does not increase in size directly in proportion to the increase in weight, but, nevertheless, there is a tendency for the sutures of the cranium to be partially ossified so that the head becomes much less compressible than usual. Moreover, the increased girth of the shoulders may lead to serious difficulty even after the head has been born. It should always be remembered that disproportion is a relative term, and that a large child may encounter as great difficulty in passing through a normal pelvis as an average size child in passing through a markedly contracted one.

The treatment will depend upon the relative size of the head and the pelvis. If marked disproportion exists radical procedures may be necessary, even though the pelvis is normal. In less marked cases the head may be born spontaneously, yet the shoulders cannot be delivered. In such circumstances, in order to diminish the circumference of the shoulders and permit the extraction of the body, it may be necessary to perform cleidotomy—severing the clavicles by means of heavy scissors.

Excessive size due to prolongation of pregnancy should not be permitted to occur if efficient prenatal care is available. The obstetrician should make it a rule whenever the expected date of delivery has passed, to examine the patient each week and to induce labor as soon as the child has attained normal dimensions. Too great stress cannot be laid upon this point, as it represents one of the great advances of modern obstetrics.

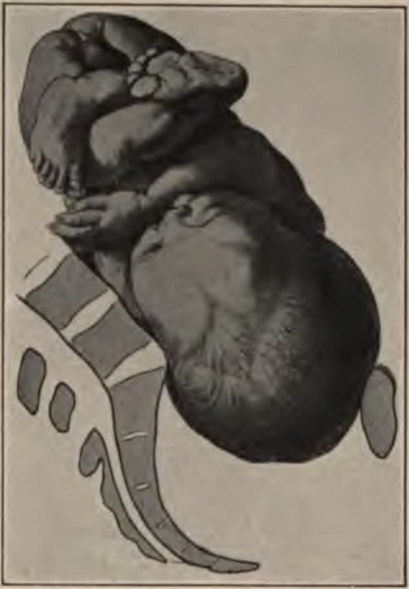


FIG. 106.—Hydrocephalus—illustrating disproportion between size of head and pelvis. (Bumm.)

Enlargement of the Body of the Fetus. —This is occasionally observed and may give rise to such difficulty during labor that partial evisceration is necessary before delivery can be completed. The most usual causes of excessive abdominal enlargements are ascites, distention of the bladder, and tumors of the kidneys or liver.

Hydrocephalus.—In this rather common condition the cerebral ventricles are distended with cerebrospinal fluid so that the skull becomes greatly increased in size. This "water on the brain" results from a mechanical interference with the normal absorption of the cerebrospinal fluid formed in the ventricles of the brain, so that the fluid collects until in extreme cases the brain substance is so compressed that it forms only a thin lining beneath the bones of the skull. At the same time the cranial bones are poorly developed, while the sutures and fontanelles are greatly widened and distended.

In advanced stages of hydrocephalus the diagnosis is made by the detection of an abnormally large head during the course of abdominal palpation or by its unusual fluctuation during vaginal exploration. The milder cases are frequently not recognized until after delivery when the large size and peculiar shape of the head are noticed.

If the condition gives rise to dystocia, craniotomy should be performed as soon as the cervix is fully dilated. This inevitably leads to the

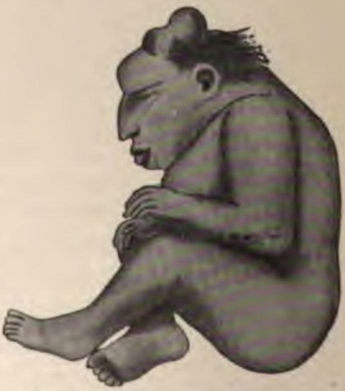


FIG. 107.—Anencephalic fetus. (Williams.)

death of the child, but is perfectly justifiable in view of the fact that, even though it should survive delivery by other means, it will either die within a few days or grow up with an extreme degree of mental deficiency.

The very mild cases can be successfully treated after birth by an operation to remove the obstruction to the proper flow of the cerebrospinal fluid, but if the brain substance has already been injured by the distention, the procedure can, at best, only check the further progress of the disease.

Anencephalus or Hemicephalus.—This is a condition resulting from failure of development of the upper portion of the skull (Fig. 107), so that the cranium and brain are lacking. This anomaly is not very rare but its etiology is still unknown. Delivery is usually spontaneous with the face of the child presenting. Fortunately, such monsters rarely survive, as postnatal treatment is of no avail.

OTHER MALFORMATIONS

Among the more commonly observed deformities we shall say a few words concerning each of the following:

Harelip.—In this condition a fissure extends through the upper lip in the direction of the nostril and sometimes connects with it. It may be limited to one side, but is sometimes double. It is due to incomplete fusion of the embryonic processes which go to form the upper part of the face.

Cleft Palate.—This is frequently associated with harelip. It consists of a fissure in the roof of the mouth due to imperfect union of the two portions of the palate growing over from the sides.

Either of these conditions may interfere with suckling and demand careful feeding with a medicine dropper or a specially constructed nipple until operation can be done, and great care should be taken to keep the mouth scrupulously clean. Operative procedures undertaken shortly after birth usually successfully restore the normal conformation of the affected parts.

Tongue Tie.—This is caused by a shortening of the frenum to such an extent that the tongue cannot be protruded. If the condition interferes with suckling, as sometimes happens, the tissues may be snipped through with scissors.

Multiple Digits (Polydactylism).—These are frequently encountered. The extra digits may be either fingers or toes, more generally the former.

The condition is definitely hereditary and inquiry will frequently show that other members of the family have been afflicted with it. Usually the supernumerary digits, attached near the little fingers or toes, are imperfectly developed, and frequently appear as pedunculated knobs of tissue without very definite form. Less often they are fully shaped, even to the extent of possessing the usual bony phalanges. The simpler cases are treated by a tight silk ligature placed around the pedicle, the tissue beyond it sloughing off within a few days. More elaborate surgical procedures are necessary for the removal of better developed digits.

Spina Bifida.—This results from the incomplete fusion of the tissues which normally enclose the spinal canal, so that some of the contents of the canal protrudes in the form of a cystic tumor which appears over the vertebral column, more frequently in the sacral region. Several varieties of spina bifida are differentiated, depending upon the contents of the sac. The condition is frequently associated with other abnormalities of development, such as hydrocephalus or anencephalus. The only hope of relief lies in operative measures, which, however, promise little success, unless the tumor contains nothing but cerebro-spinal fluid.

Atresia Ani.—This is occasionally met with and is generally very serious. The condition results from faulty development of the lower part of the intestinal tract, and is incompatible with continued life unless relief is obtained. Occasionally, the imperforate portion is little more than an obstructing membrane and a relatively simple operation suffices for its cure, but when a portion of the tract is absent or is represented only by a cord of tissue, plastic surgery is rarely of avail. In such cases the bowel obstruction can be relieved by colostomy, but it is doubtful whether it is justifiable in view of the conditions which must persist until death relieves the unfortunate infant.

Club-Foot (Talipes).—This is a condition in which the feet are twisted out of shape or position. There are several well-recognized varieties. A definite etiology cannot be assigned, but it is probably the result of intra-uterine pressure and can be corrected by appropriate orthopedic procedures during the early weeks of life. The usual bow-legged attitude of the newborn child frequently suggests club-foot, but closer inspection will show that the angle between the foot and the leg is quite undisturbed.

Double Monsters.—In the discussion of single-ovum twins, it was stated that they probably resulted from the splitting into equal parts of an ovum at a very early period when it was composed of only a few cells. If the separation is incomplete, a variety of double monsters will result, whose appearance and anatomical conformation will vary with the completeness of the division. In the Siamese twins and similar monstrosities, there was only a slight band of connecting tissue, which has tempted surgeons, usually unsuccessfully, to effect complete separation by surgical measures, while at the other extreme the only evidence of the double formation may be the presence of four legs or two heads.

CHAPTER XII

ABORTION, MISCARRIAGE, PREMATURE LABOR AND EXTRA-UTERINE PREGNANCY

Spontaneous expulsion of the ovum may occur before full development has been attained, and is designated as *abortion, miscarriage,* or *premature labor,* depending upon the period to which gestation has progressed. Termination of the pregnancy before the end of the sixteenth week constitutes an *abortion,* between the sixteenth and the twenty-eighth a *miscarriage,* and from then until the end of the thirty-sixth week a *premature labor.* The first two groups are frequently included together and designated as miscarriages by the laity, or as abortions by the medical profession, and we shall consider them together.

ABORTION AND MISCARRIAGE

During the first four months of gestation the placenta is only imperfectly developed and, in consequence, the entire ovum often comes away intact, whereas, later in pregnancy, the child and placenta are usually expelled separately.

When the whole product of conception is extruded together, we speak of a *complete abortion,* while the term *incomplete abortion* indicates that the placenta and membranes are retained after the expulsion of the fetus. The latter are quite unusual throughout the first eight or ten weeks, but are encountered with increasing frequency during the third and fourth months, and, after the latter period, separate expulsion is the rule.

Frequency.—It is impossible to say how frequently abortions occur, but all authorities are agreed that they are very common. It is safe to say that at least one pregnancy in every five terminates spontaneously during the first seven months, and the proportion would undoubtedly be increased if it were possible to include the cases in which the ovum is expelled during the profuse flow, which appears some days or weeks after the period was expected, and which is frequently regarded merely as a retarded menstruation. Abortion occurs much more frequently during the early part of gestation than between the fifth and seventh months.

Etiology.—Abortions are classified as *spontaneous,* when due to conditions over which the patient and physician have little or no control, and as *induced* when brought about voluntarily. The latter may be either *therapeutic* or *criminal;* the first being performed by the doctor to save the life or preserve the health of the mother, while in the second an undesired pregnancy is interrupted illegally by the patient herself or by a professional abortionist. Criminal abortion is becoming more common in all parts of the world, and is not included in the figures given above.

Spontaneous abortion is almost invariably preceded by the death of the fetus, and its most common causes are: (1) abnormalities of the fetus; (2) malposition of the uterus; and (3) uterine disease. Other factors, such as injuries, falls, nervous shocks and fevers may occasionally be responsible. Faulty development, which is incompatible with continued intra-uterine life, is probably the most frequent cause of fetal death, while malpositions and disease of the uterus are important factors. In the last-mentioned conditions, the blood supply of the growing ovum is interfered with, so that the embryo dies from lack of nourishment. It is doubtful whether syphilis plays any part in the production of early abortions, although later it is known to be the most important cause of fetal death.

It is customary to designate as *predisposing causes* the conditions which have been mentioned above as causing fetal death, and, as *exciting causes,* the relatively insignificant injury, fall or overexertion, which immediately precedes the onset of symptoms. In some instances, the most trivial accident may be followed by an abortion, whereas in other women great violence or even extensive intra-uterine manipulations will not interrupt the pregnancy.

Repeated spontaneous abortions occasionally occur even in women who are willing to go to any extreme to have a living baby. Very often they are attributable to some recognizable pathological condition, whose relief will be followed by a normal pregnancy, but frequently no demonstrable lesions can be found. In such circumstances, the condition represents one of the unsolved problems of obstetrics.

Pathology.—The immediate cause of most abortions consists in the occurrence of hemorrhage into the decidua, although we do not know why it should occur so promptly after the death of the fetus. As a result of the bleeding, the ovum is loosened from its attachment to the uterine wall and comes to act as a foreign body, which irritates the uterus and stimulates rhythmic contractions that continue until the separated tissues are expelled. In the early weeks, the ovum and the entire decidual membrane may come away in a single mass, or the shaggy ovum may be expelled alone, while the decidua is discharged in fragments in the lochia. Later, the tendency is for the fetus to be expelled spontaneously, while the placenta remains *in utero* until removed artificially.

Occasionally, when the hemorrhage into the decidua occurs very slowly, the blood may coagulate, and so completely surround the ovum, that the material expelled will resemble a large blood clot. Such masses are termed *blood moles* from their appearance.

Symptoms.—Clinically, it is customary to classify abortions as threatened, imminent or inevitable, according to the presence or absence of certain signs and symptoms. An abortion is said to be *threatened* when the patient begins to bleed slightly and has occasional cramps in the back or lower abdomen. If, however, the hemorrhage becomes profuse and the cervical canal dilates to any considerable extent, it becomes *imminent*, but is *inevitable* only after the membranes have ruptured and the amniotic fluid has escaped.

A slight bloody discharge is usually the first indication of a threatened interruption of the pregnancy, and may not be followed by cramplike pains until some hours or days later. During the actual expulsion of the ovum, however, pain may be the predominant symptom and usually indicates a more gloomy prognosis than bleeding alone. Abortion is not accompanied by fever, unless the uterine contents have become infected, while an increase in the pulse rate may signify excessive bleeding or may be the accompaniment of the elevation of temperature.

Treatment.—The treatment varies according to the stage at which the patient is first seen. If the abortion is merely threatened, the indications are for absolute rest, combined with medicinal treatment to combat individual symptoms. The patient should be put to bed with an ice cap over the lower abdomen. If uterine pains occur, a single dose of morphine ($^1/_4$ grain—15 milligrams), or codein (1 grain—60 milligrams) may be given hypodermatically, to be followed by rectal suppositories of extract of opium (1 grain—60 milligrams), or codein ($^1/_2$ grain—30 milligrams) by mouth, repeated every four to six hours. If the bleeding stops and the pains cease under such treatment, active measures are not required, although the patient is kept in bed for a week or ten days to avoid the possibility of recurrence; if, however, the symptoms persist, the procedures indicated should be continued until it is evident that there is no hope of saving the pregnancy. Persistence of the bleeding and pain generally indicates a poor prognosis, and an abortion is rarely averted, unless the response to treatment is prompt.

The first symptoms are frequently noticed about the time the menstrual period would usually occur, and the onset of bleeding suggests some connection with menstruation. In such cases, rest in bed should be enforced at the time and for the next two or three months the patient's activities should be curtailed at the time the period should normally appear.

When the bleeding is profuse, or whenever the abortion appears to be inevitable, the uterus should be emptied in the most conservative manner. If the cervix is sufficiently dilated, the patient is anesthetized and the finger passed into the uterus under aseptic precautions. After the ovum has been gently peeled from its attachments, it is removed with placental forceps, and a hot intra-uterine douche of sterile water is administered to wash away any fragments of tissue that remain. If, however, the cervical canal is closed, it must be dilated before the abortion can be completed. In general, this can be most safely effected by the introduction of a tight gauze pack into the cervix and upper vagina, and upon its removal twelve to twenty-four hours later, the cervix will usually be found well dilated and the ovum may be brought away with the gauze. Occasionally, when the hemorrhage is very profuse, or, in cases in which the pack has been ineffectual, it may be necessary to dilate the cervix rapidly by means of a metal dilator—Goodell or Hegar.

The best authorities oppose the routine employment of a curette for emptying the uterus for two reasons: first, the uterus is so softened during pregnancy that there is considerable danger of perforating it with the instrument, and, secondly, the operator can never be sure that he has removed the entire product of conception unless a finger has demonstrated that the uterus is empty. In incomplete abortions, the retained placenta should be removed by the finger and ovum forceps. If the cervix is closed, it may be dilated with the finger or by means of metal dilators. The presence of a definite uterine infection demands the immediate emptying of the uterus followed by a copious irrigation with sterile water.

Prognosis.—Abortions rarely prove fatal unless they are complicated by infection with such virulent bacteria as streptococci. Severe infections commonly follow criminally induced abortions, and are responsible for the high death rate attending such operations.

Nursing Care.—The nurse in attendance upon a patient with a threatened abortion must insist upon absolute quiet. Medicinal measures and diet will be prescribed by the physician, and cathartics and enemata should not be given unless specifically ordered, as they may stimulate uterine contractions and annul the effects of other treatment. The temperature and pulse must be recorded every four hours. Everything passed from the vagina should be preserved for inspection by the physician, as it is only in this way that he can judge how much of the ovum has been expelled.

In cases of criminal abortion, the nurse shares with the doctor the responsibility for educating the patient regarding the moral and legal wrong of the procedure, as well as the dangers associated with it. Ordinarily, the laity do not appreciate the moral aspects of the question because of the popular belief that the fetus is not alive until active movements are felt. When it has been explained that life is present from the moment of conception, and that its destruction is as great a crime as killing a year-old baby, the patient may change her views concerning the gravity of the procedure. It may likewise be worth while to emphasize its danger, as well as the fact that no reputable physician will consent to induce criminal abortion, and to point out that the professional abortionist represents the scum of the medical profession, who has found competition with capable doctors so strenuous that he is willing to eke out his livelihood by forbidden means.

Missed Abortion.—This term is applied to the rather rare condition, in which the fetus is retained in the uterine cavity for weeks or months after its death. The failure of the uterus to expel it is attributed to a lack of irritability of the uterine muscle, although it must be admitted that such an explanation is open to question. In such cases, the patient presents the signs of threatened abortion, which disappear spontaneously or under treatment, so that it is believed that the accident has been averted. Weeks or months later it becomes apparent that the uterus is not growing as it should, and the diagnosis is made. More rarely, death of the fetus is not followed by any symptoms of abortion, when the prolonged amenorrhea and lack of abdominal enlargement call attention to the possibility of the abnormality. The condition may persist for months without symptoms or may be accompanied by loss of weight, a foul taste in the mouth, or a slight fever. When expelled, the ovum frequently presents the appearance of a blood mole, but may be partially or completely resorbed. Treatment consists in emptying the uterus as soon as feasible after the diagnosis is established.

Therapeutic Abortion.—Therapeutic or medical abortions are indicated by the existence of some disease on the part of the mother which will seemingly be aggravated by the continuance of the pregnancy. In order to avoid possible legal complications, the necessity for the interruption of the pregnancy must be determined by consultation between two or more physicians. The more usual indications are offered by active pulmonary tuberculosis, poorly compensated cardiac lesions, chronic nephritis and pernicious vomiting. The pregnancy may be terminated by the introduction of a bougie or pack into the uterus, or by the instrumental dilatation of the cervix followed by removal of the ovum, but, when haste is essential, vaginal or abdominal hysterotomy is preferable, the latter being employed only when it is deemed advisable to sterilize the patient at the same time.

Late Abortion.—Abortions occurring during the fifth to seventh month of pregnancy (strictly known as miscarriages) are relatively uncommon, as compared with those in the earlier months, for the reason that the more seriously affected ova are eliminated by abortions prior to this period. The same etiological factors are concerned, although syphilis now begins to play an important rôle. The clinical course is similar to that described for early abortions, except that it is the rule for the membranes to rupture, so that the fetus is expelled by itself, and is later followed by the placenta and the membranes. The process more nearly simulates full term delivery, in that the placenta can usually be expelled by pressure on the uterus, thus making its manual removal the exception. Occasionally, however, the entire product of conception comes away at one time.

PREMATURE LABOR

By the term *premature labor* is understood the spontaneous termination of pregnancy after the twenty-eighth week, when the child has become viable, but before it has attained maturity. Children are designated as premature when they weigh between 1500 and 2500 grams ($3^1/_3$ and $5^1/_2$ pounds) and measure between 35 and 45 centimeters (14 and 18 inches) in length.

This accident is by no means uncommon, and may be due to numerous factors, the most important being untreated syphilis of the mother (40 per cent). Among the other etiological factors may be mentioned:

Eclampsia and allied intoxications, together with chronic nephritis.

Previous operations on the generative tract, more especially high amputation of the cervix.

Over-distention of the uterus by hydramnios or multiple pregnancy.

Placenta previa and premature separation of the placenta.

The expulsion of a macerated fetus, or the history of repeated premature labors, should always suggest the possible existence of syphilitic infection, and a conscientious search should be made for manifestations of the disease, particularly as thorough treatment will generally permit succeeding pregnancies to end in the birth of healthy full-term children. The prophylactic treatment of the other factors is more difficult, and in some cases nothing can be done to prevent the recurrence of the accident.

The course and treatment of a premature labor scarcely differs from that of labor at full term, except that in rare instances the fetus and placental mass will be expelled simultaneously. Occasionally, when the patient is seen very early, it may be possible to avert the accident in the interests of a living child by rest and the administration of sedative drugs, as advocated in the treatment of threatened abortion.

EXTRA-UTERINE PREGNANCY

In extra-uterine pregnancy the fertilized ovum becomes implanted and undergoes more or less complete development at some point between the ovary and the uterine cavity. The term *ectopic gestation* has a broader significance and includes, in addition, the rare cases in which the ovum develops in the interstitial part of the fallopian tube or in the rudimentary horn of a bicornuate uterus.

According to the site of implantation of the ovum, extra-uterine pregnancies are designated as *tubal* or *ovarian,* the latter being extremely rare. *Abdominal pregnancy* is also recognized as a secondary variety, but it is believed that it invariably originates as a tubal or ovarian pregnancy.

No statistics are available to indicate the proportion of extra-uterine to uterine pregnancies, but perhaps it is safe to say that one-half to one per cent of all fertilized ova become imbedded outside the uterine cavity. At any event, the possibility is always to be borne in mind when dealing with obstetrical patients, especially in the early months.

Causes of.—Normally the spermatozoa meet the ovum near the fimbriated end of the fallopian tube, after which the fertilized egg is propelled slowly toward the uterine cavity by the action of the cilia of the tubal epithelium. As a rule, the lumen of the tube is sufficiently large to permit this passage, so that, in order for the ovum to be arrested before it reaches the uterus, its progress must be impeded by some mechanical obstruction.

The two most frequent etiological factors concerned with the production of such obstructions are chronic inflammatory processes, usually of gonorrheal origin, and developmental abnormalities affecting the lumen of the tube. Either of these factors may so narrow the passage through the tube, that, although the spermatozoa can easily pass up, the fertilized and growing ovum may be blocked at some point in its journey to the uterine cavity and become implanted at its place of lodgment.

Primary Ovarian Pregnancy.—This is excessively rare and results only when the spermatozoön passes beyond the tube and fertilizes an ovum, which has remained free in the cavity of a ruptured graafian follicle. The secondary inclusion of the ovary in the wall of a fetal sac derived from a ruptured tubal pregnancy may sometimes lead to the unwarranted conclusion that the original site of implantation had been in the ovary.

As has already been indicated, abdominal pregnancies are probably never primary, in the sense that the fertilized ovum becomes imbedded directly upon the peritoneum. The usual method of production is that an early tubal pregnancy ruptures and extrudes the fetus and its membranes into the peritoneal cavity, while the placenta remains attached to the tube wall, whence it spreads over the surrounding organs.

Both ovarian and secondary abdominal pregnancies are so uncommon that they will be largely ignored in our discussion.

The Anatomo-Pathology of Tubal Pregnancy.—Mention has already been made of the changes occurring in the uterus in preparation for the reception of the fertilized ovum. The endometrium becomes thicker and more complicated in structure and gives rise to the decidua, whose functions are to furnish a place for the implantation of the ovum, as well as to protect the underlying maternal tissues from the invasive action of the fetal cells. The tubal mucosa, by contrast, undergoes little or no decidual reaction in the presence of the fertilized ovum, so that when it has penetrated beneath the epithelial layer, it is situated within the thin muscular wall of the tube, which is rapidly invaded by the fetal cells. At first the tube dilates to accommodate the growing product of conception, but within a short period the limit of distensibility is reached and the capsule surrounding the ovum ruptures either into the lumen of the tube or into the peritoneal cavity giving rise to a *tubal abortion* or a *tubal rupture*.

Tubal abortion is many times more common than rupture and generally occurs when the site of implantation of the ovum is in the outer third of the tube. In this event, the invasive chorionic cells at the periphery of the ovum gradually weaken the thin layer of tissue which separates it from the tubal lumen, and, finally, increasing tension causes this membrane to rupture, with the partial or complete expulsion of the product of conception. If the end of the tube is patent, the ovum and blood, which thus find their way into its lumen, are expelled into the abdominal cavity. The separation of the ovum is associated with bleeding, which, just as in a uterine pregnancy, continues until the process is complete.

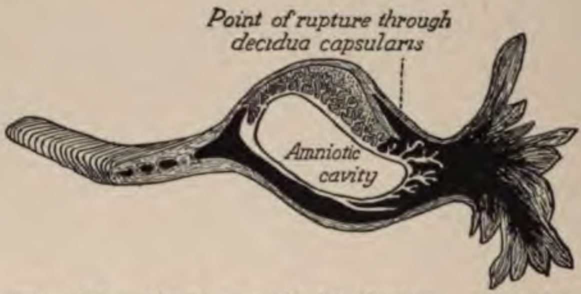


FIG. 108.—Schematic diagram of tubal abortion. (After Bumm.)

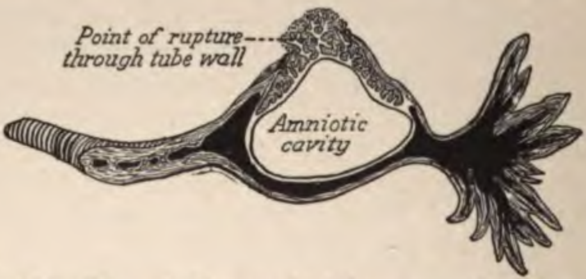


FIG. 109.—Schematic diagram of tubal rupture. (After Bumm.)

Thus two types of tubal abortion are differentiated—complete and incomplete. In the former, the loss of blood soon ceases and spontaneous recovery occurs, whereas, in the latter, symptoms indicative of continuing hemorrhage appear and frequently necessitate operative intervention. If the end of the tube is occluded by adhesions, the escape of its contents is prevented, when the continued hemorrhage from the torn vessels so increases the distention of the tube wall, that it eventually gives way and produces the clinical picture commonly associated with tubal rupture.

Rupture of the pregnant tube occurs in approximately one-eighth of the cases of tubal pregnancies, and is especially frequent when implantation has occurred in the uterine end of the tube. In this location, the available lumen is so small that the ovum can not escape into it. Consequently, the fetal cells invade the muscular wall of the tube, almost like a malignant growth, and soon reach and penetrate its outer covering. When this occurs, the ovum escapes into the peritoneal cavity, or occasionally between the folds of the broad ligament, while profuse bleeding occurs through the tear. The actual rupture usually occurs spontaneously, but it sometimes follows violence, such as a vaginal examination, a fall, or some sudden straining effort. The bleeding usually ceases when the ovum has been completely expelled, unless a large vessel has been torn through.

Changes in the Organs.—The affected tube undergoes considerable hypertrophy with a variable but small increase in the muscle. For the first two or three months, the uterus enlarges as if it contained the ovum, and its endometrium becomes transformed into a real decidua. When the fetus dies as a result of tubal abortion or rupture, the decidual lining is cast off in small pieces or in rare instances as a triangular cast of the uterine cavity, the process being associated with vaginal bleeding. Other organs, such as the breasts, undergo the changes usually associated with pregnancy, but return to normal after the ovum perishes.

Fate of the Ovum.—In only a small percentage of cases does the pregnancy advance beyond the third or fourth month. Tubal abortion and rupture usually destroy the placental attachment or so injure the embryo that further growth is impossible. When the patient recovers without operative interference, the early fetus is rapidly absorbed and frequently leaves no trace of its existence. Owing to the unusual conditions under which development has taken place, the fetus generally presents abnormalities which are inconsistent with extra-uterine existence. Very rarely, following rupture of the tube, the placental attachment persists, and the fetus, which has escaped into the peritoneal cavity surounded by its membranes, continues to develop and may reach maturity. In this event, delivery may be effected by laparotomy, while occasionally the fetus may remain in the peritoneal cavity for years after its death without giving rise to serious symptoms.

Diagnosis of Extra-uterine Pregnancy.—This is usually so difficult, that the diagnosis of extra-uterine pregnancy is rarely substantiated at operation, unless the tube has ruptured or tubal abortion has occurred. Ordinarily, one or more menstrual periods have been missed or have presented irregularities in frequency, duration or amount. There may be indefinite pelvic discomfort on one side or the other. Before the occurrence of rupture, vaginal examination reveals the findings characteristic of early pregnancy, perhaps some tenderness on the side affected, and occasionally a definite enlargement of the tube, but usually the condition is attributed to a normal uterine pregnancy, which is perhaps associated with mild pelvic inflammatory disease.

With the occurrence of rupture or abortion, however, the entire picture rapidly changes, and is characterized, as a rule, by sudden, sharp pain, localized in one side of the lower abdomen, associated with evidence of internal hemorrhage and shock. The patient becomes pale and may faint, the pulse rate is rapid, the temperature may be subnormal, and the red blood count and hemoglobin percentage are low. Death may occur within a few hours unless the bleeding is controlled by operative measures. Tubal abortion generally causes less severe symptoms than rupture, and, after the first sudden symptoms, a marked improvement is frequently noted and rapid convalescence occurs without operation. Rupture is less apt to be followed by spontaneous recovery, as the progressive shock associated with continued bleeding into the peritoneal cavity frequently demands surgical intervention.

The rare cases of secondary abdominal pregnancy are usually not diagnosed until *false labor* sets in, when the physician notes that conditions are not normal. The pains which result from the efforts of the uterus to expel the decidua are regular in character, but do not implicate the abdominal tumor, and so can not lead to the termination of labor. It may also be noticed that the fetus can be palpated with unusual ease. Vaginal examination reveals a small, softened cervix with long canal, while the body of the uterus can sometimes be distinctly differentiated from the main abdominal mass.

Treatment.—On account of the danger of rupture or abortion with severe and perhaps fatal hemorrhage, the diagnosis of an unruptured extra-uterine pregnancy demands prompt laparotomy with the removal of the affected tube. In the presence of a tubal abortion with rapid recovery from the original shock and the evident formation of a hematocele, expectant treatment is the rule. If the blood is not absorbed or becomes infected, it may be drained later through a vaginal incision and the cavity packed with gauze. Frank rupture, on the other hand, with increasing evidences of shock, demands immediate operation, as it offers the only chance of preventing death from hemorrhage. Various stimulants, saline infusions, and of recent years, blood transfusion are frequently employed to tide the patient over the strain of the operation.

Generally, a low mid-line incision is made, the blood removed from the abdominal cavity and the affected tube or ovary exposed to view. Bleeding is controlled by rapidly placed sutures or by long clamps, after which the diseased tissues are removed. As a rule, no attempt is made to preserve the tube, but if the ovary is not seriously involved it is left *in situ*. As such patients are frequently poor operative risks, it is unwise to do more than is actually necessary to check the bleeding. Many operators prefer to leave some of the free blood in the peritoneal cavity, in the belief that it will be absorbed and thus replace part of the loss, while others introduce a quantity of warm salt solution before closing the abdominal incision. A general anesthetic is usually given, but in certain extreme cases local anesthesia may be preferable.

In the rare cases of advanced pregnancy, the child is extracted through an abdominal incision and the easily separated portions of the placenta are detached, but no effort is made to remove the adherent fetal sac, which is packed with gauze and left to be sloughed off during the convalescent period. Experience has taught that attempts to remove the entire sac are frequently associated with profuse oozing, which may become uncontrollable, and lead to the death of the patient from hemorrhage.

After-care.—The post-operative care differs in no essential detail from that generally employed after laparotomy for other causes, although it should be remembered that a slight amount of vaginal bleeding may be expected when the uterine decidua is expelled.

CHAPTER XIII

ACCIDENTAL COMPLICATIONS OF PREGNANCY

Pregnancy may be complicated by various diseases acquired before conception or which develop during the gestation period, as well as by others, which arise from the condition itself. The former are regarded as *accidental complications* and serve to disturb the physiological course of pregnancy by introducing other disease factors. In a certain sense, pregnancy may be regarded as a time of testing for the whole organism; so that many lesions, hitherto unsuspected, are brought to light under the added strain imposed upon the various organs, particularly during the latter months.

In general, it may be said that pregnancy has a bad influence upon all chronic diseases and to a lesser extent upon most acute infectious diseases; at the same time, both types of diseases frequently cause the death of the child and lead to its premature expulsion.

ACUTE INFECTIOUS DISEASES

As *measles, scarlet fever, smallpox* and *diphtheria* are not of frequent occurrence among adults, they rarely complicate pregnancy. When they do occur, the course of the disease is not materially altered, but abortion is frequent, if the temperature remains elevated for any considerable period. Measles and smallpox may be transmitted to the fetus, so that at birth it may present the eruption typical of the disease.

Typhoid Fever.—This is a more serious complication, and frequently proves fatal to the mother and the child. The death of the latter is due to its infection by the typhoid bacilli, and the added strain of its expulsion may prejudice the mother's chance of recovery.

Pneumonia.—Pneumonia occurring during pregnancy has a more gloomy prognosis than at other times, so that its death rate is considerably increased. By reason of the deficient oxygenation of the mother's blood, incident to the consolidation of the lung tissues, the fetus frequently fails to obtain sufficient oxygen and dies from asphyxiation. This accident more commonly occurs at the most serious stage of the disease, when the cyanosis is extreme, and the resulting abortion or premature labor may turn the scales against the mother.

Influenza.—Influenza as it occurred in the recent epidemics, is particularly serious when complicating pregnancy. Statistics indicate that about one-quarter of all such cases died, and, when pneumonia developed, that the mortality rate rose to fifty per cent. Moreover, the occurrence of abortion or premature labor has a very deleterious effect upon the disease. Fortunately, except in serious pandemics, the course of the disease is comparatively mild, so that it is not ordinarily considered a particularly serious complication.

Erysipelas.—Erysipelas occasionally develops during pregnancy, and, as it is due to streptococcus infection, it is especially dangerous because of the possibility of the development of puerperal infection, should delivery occur during the course of the disease. Consequently, if this complication is to be avoided, the most careful and conscientious aseptic technic is essential on the part of all the attendants.

Pregnancy may be complicated by other of the acute infectious diseases, such as *anthrax, tetanus* and *yellow fever,* but they are too uncommon to be considered here.

The treatment of the various diseases mentioned is not influenced by the existence of pregnancy and is carried out as detailed in the books on medical nursing. The application of an ice-cap to the lower abdomen, and, if not contra-indicated, the administration of a sedative, may tend to decrease the irritability of the uterus and thereby prevent abortion or premature labor. Care should also be exercised in the use of strong cathartics, as they may stimulate uterine contractions.

Gonorrhea.—This rarely has any bad effect upon the pregnancy, although it may occasionally lead to abortion, if the gonococci have invaded the decidua. On the other hand, its relation to ophthalmia of the newborn, as well as to serious puerperal infection in the mother, demands that it should always be given serious attention. The usual treatment with vaginal and urethral instillations and irrigations may be employed, except during the last month, when they should be discontinued or only given under strict aseptic precautions by the physician or nurse.

CHRONIC INFECTIOUS DISEASES

Of the chronic infectious diseases, only tuberculosis and syphilis need be considered at length. They should be viewed from two angles; the effect of the disease upon the pregnancy, and the effect of the pregnancy upon the disease.

Tuberculosis.—Tuberculosis rarely leads to the premature interruption of the pregnancy, and as a rule tuberculous women give birth to normally developed, healthy children. In a few reported instances, the disease has been transmitted to the fetus *in utero,* but such congenital occurrence is so uncommon that it can be ignored.

On the other hand, pregnancy generally exerts a pernicious influence upon the course of tuberculosis, and for that reason women suffering from it should not marry, or if they are already married, they should prevent the occurrence of pregnancy until the process has been arrested and apparently cured. Even in the latter event, there can be no assurance that the old lesion may not flare up during pregnancy or as a sequel to the strain of labor and subsequent lactation.

In certain instances, the tuberculous patient goes steadily downhill during pregnancy, but, more usually, her condition seems to improve during gestation, only to be followed by a severe exacerbation following it. In fact, even in the fibroid type of the disease, the prognosis is usually somber, so that the existence of any tubercular lesion complicating pregnancy should always be a cause for anxiety.

If the tuberculous patient is pregnant when first seen, the treatment depends upon the period to which the pregnancy has advanced, as well as upon the extent and activity of the lesion. When one has to deal with an active pulmonary or laryngeal process in a woman early in pregnancy, it is generally agreed that the uterus should be emptied immediately by the most conservative means. On the other hand, if she is first seen after the middle of pregnancy, it is usually recommended that the opposite course be pursued in the interest of the child, since the strain of a premature labor exerts as deleterious an effect upon the mother as delivery at full term. Should the death of the patient seem imminent, operation may be indicated solely in the interest of the child, if it has reached the period of viability.

When the patient presents a healed lesion, the course to be pursued depends upon the interval which has elapsed after the disappearance of active signs and symptoms. If it is only a few months, the safest course is to end the pregnancy, but, if the process has been quiescent for several years, the opposite plan may be decided upon, and the patient surrounded with the very best hygienic conditions as an extra safeguard. In such circumstances, steps should be taken to reduce the strain of labor as much as possible, to give a minimal amount of anesthetic and to avoid excessive loss of blood. To this end, the patient should be anesthetized with gas and oxygen, and delivered by the most conservative procedure as soon as the cervix is fully dilated.

When the pulmonary lesions are especially extensive or develop in women who already have several living children, the question of sterilization is apt to come to the fore in discussing the treatment during early pregnancy. In such conditions, there is a growing tendency to empty the uterus after performing laparotomy, and then to make subsequent pregnancy impossible by bisecting the tubes and burying their uterine ends in the folds of the broad ligaments. Such an operation, however, should be done only after the most careful consideration of all aspects of the case, for the reason that, even though the patient recovers full health and is anxious for more children, fertility can be restored only by means of another, and very delicate, operation.

Although there is little probability that the child of a tuberculous patient will be born with hereditary lesions, it should be kept under the most hygienic conditions and be prevented from coming in close contact with the mother as long as she presents active lesions. Consequently, it should not be allowed to suckle her.

Tuberculous patients, who have had a pregnancy interrupted in the early months, or who have been delivered at term, should be advised of the dangers of again becoming pregnant. The husbands should likewise be warned, and may legitimately be instructed in regard to contraceptive methods.

Syphilis.—This is one of the most important complications of pregnancy, but, in contrast with tuberculosis, it effects the child rather than the mother, and thus stands out as one of the most frequent causes of fetal death. In general, the mother is little affected and in fact clinical observations tend to show that gestation may influence the course of the disease in an unexpectedly favorable manner.

Syphilis is an infectious disease produced by the Treponema pallidum, and is usually acquired during sexual intercourse. Consequently, the initial lesion is generally situated upon the genital organs, although occasionally it may develop upon other parts of the body. About two weeks after infection, there appears at the site of inoculation a single small indurated lesion—*the primary sore* or *chancre,* which heals spontaneously within the next two months, leaving a scar to mark its site. The Treponemata rapidly gain access to the blood stream, and, four to eight weeks after the appearance of the primary sore, produce the secondary manifestations, the most prominent of which are a skin rash, alopecia (baldness) limited to small scattered areas of the scalp, general enlargement of the lymphatic glands, mucous patches in the mouth, and moist condylomata around the genital region. The later, or tertiary, lesions more commonly affect the vascular or nervous systems, and may not appear until many years after the original infection.

The Wassermann reaction in the blood serum is the usual laboratory method of diagnosis, and for practical purposes it may be said that the presence of a positive reaction means that the patient has syphilis. On the other hand, a single negative result is inconclusive; whereas repeated negative results in the absence of clinical signs may be regarded as satisfactory evidence that the patient has not been infected.

As judged by the frequency of a positive Wassermann reaction, syphilis is present in about ten per cent of the poorer classes of women applying to obstetrical hospitals, but its incidence among private patients is much less. In hospital practice, particularly when many of the patients are colored, one-quarter to one-third of all fetal deaths, occurring *in utero* after the period of viability has been reached, as well as during the first two weeks of life, are directly attributable to syphilis. This will include about forty per cent of all stillborn premature infants and eighty per cent of all macerated fetuses.

The influence of syphilis upon the product of conception varies according as infection occurred before pregnancy, at the time of conception, or during pregnancy. In the first two groups, the child is practically always syphilitic; whereas in the last, the result depends upon whether the infection occurred in the early months or during the latter half of gestation. In the former event, the child usually shows signs of the disease, while in the latter it may escape infection. Moreover, in either group, the child may be born apparently healthy, but later develop signs of congenital syphilis.

The effect of a syphilitic infection upon the fetus and the placenta has already been discussed, and in the chapter on diseases of the newborn it is stated that it is doubtful whether congenital syphilis can be cured with our present therapeutic measures. On the other hand, those in a position to know state definitely that adults suffering from acquired syphilis can be cured by appropriate treatment. Moreover, in the treatment of pregnant women, the drugs administered to the mother are transmitted to the child *in utero,* and may either prevent it from becoming infected, or, if infection has already occurred, lead to the cure of the disease and the birth of a healthy child. Indeed, evidence is available to indicate that smaller amounts of medication lead to cure during pregnancy than at any other time. Such statements clearly place the responsibility for the elimination of congenital syphilis largely upon the obstetrician, and consequently all who do obstetrical work should realize its importance.

Diagnosis.—Among women patients it is especially difficult to obtain a history of syphilitic infection, for the reason that, as the primary sore is quite painless, it is frequently overlooked, while many believe that it is ordinarily less prominent than in man. Moreover, the skin eruptions, mucous patches, and other secondary manifestations may be comparatively trifling and are quickly forgotten, with the result that even careful questioning fails to elicit a satisfactory history. In many instances, the first suggestion of the existence of the disease is afforded by the history of the birth in previous pregnancies of premature children, who were either stillborn or died shortly after birth. Such a history should at once arouse suspicion, and lead to a Wassermann blood test. In such cases, the husband should also be carefully questioned and his blood examined. If there is evidence of the disease, he likewise must be thoroughly treated.

Treatment.—The modern treatment of syphilis consists in the intravenous injection of one of the newer arsenical preparations (salvarsan, diarsenol, etc.) at intervals of a week or ten days, until the Wassermann reaction becomes negative, followed by prolonged treatment with mercury and potassium iodid. During pregnancy, if the child is to be saved, it is essential that treatment should be begun as early as possible, particularly as the injections prevent, rather than favor, the premature expulsion of the fetus.

It should always be borne in mind that the logical method of combating the evil effects of the disease on the new generation consists in the strict application of eugenic principles. No man or woman with active syphilis should be allowed to marry, and one of the good effects of the proposed legislation demanding a physical examination of both parties before the issuance of a marriage license would be to eliminate this possibility. After appropriate treatment and observation extending over several years with no signs of a return of the disease, marriage may be safely allowed, with every prospect that the offspring of the union will be normal.

Prognosis.—The large majority of the children born to mothers who show any signs of syphilis will have the disease, unless efficient treatment has been carried out during pregnancy. In two-thirds of the untreated cases, the children are stillborn or present evidence of the disease, while, in many of the others, definite lesions appear during the next few months. On the other hand, thorough treatment during pregnancy, leading to the disappearance of the positive Wassermann reaction, will reduce the initial death rate to less than ten per cent. Even under these circumstances, certain of the children will later develop signs of syphilis, but it is believed that the majority of them are quite healthy.

Pregnancy itself seems to have a favorable action upon the disease, so that in certain instances succeeding pregnancies will so modify the severity of the infection that eventually full-term children will be born alive, even though they show evidences of congenital syphilis. It is rare to find any signs of the disease among pregnant women, and consequently they are said to have "latent syphilis." The only way by which they may be detected and treated is by the previous obstetrical history and by means of the Wassermann reaction.

Malaria.—Malaria occasionally complicates pregnancy, but in temperate regions, where the infection is relatively mild, it rarely leads to the interruption of pregnancy, although in the tropics the high fever may cause miscarriage or premature labor. Chronic malarial infection may suffer an acute exacerbation during pregnancy or the puerperium. The diagnosis is made from the characteristic course of the fever, but particularly by the demonstration of the causative parasites in the blood. The usual treatment is with quinine, and the ordinary doses may be given without danger of exciting uterine contractions.

DISEASES OF THE CIRCULATORY SYSTEM

In general, diseases of the circulatory system tend to become aggravated during pregnancy, and, in many cases, the damage thus sustained is permanent in character, and may lead to death sooner than would otherwise have occurred.

Chronic Valvular Disease of the Heart.—As valvular lesions of the heart have no effect upon fertility, pregnancy is not infrequently thus complicated. The seriousness of the complication depends upon the degree to which hypertrophy of the cardiac muscle has succeeded in compensating the lesion. It is generally believed that mitral stenosis, either with or without an insufficiency, is the most serious lesion, and that aortic insufficiency ranks next. Mitral regurgitation ordinarily causes little anxiety.

Patients with recognized valvular lesions should be kept under close observation during pregnancy, and, at the first sign of a break in compensation, they should be put to bed and given suitable medicinal treatment. If rapid improvement does not follow, it may be necessary to induce labor. In the majority of such patients, however, satisfactory compensation is maintained throughout pregnancy. The psychic disturbances associated with labor combined with the usual rise in blood pressure, as well as the additional muscular effort involved in the second stage, increase the likelihood of serious trouble. For this reason, it is usually recommended that the patient be anesthetized with ether and delivered by the most conservative means as soon as the cervix becomes fully dilated.

When a serious break in compensation necessitates the artificial termination of pregnancy, the choice of method varies according to the period at which the alarming symptoms appear. If in the early months, the cervix may be dilated by means of a gauze pack left in place for twenty-four hours, and followed by digital removal of the ovum, or, in more serious cases, the uterus may be emptied at one sitting by vaginal hysterotomy. In the later months, especially after the child has become viable, cesarean section affords the most conservative method of delivery.

Marriage should not be forbidden to women with heart lesions, but the possible serious consequences of child-bearing should be explained to them, so that they will place themselves under the care of a competent physician at the onset of pregnancy.

Myocarditis.—Myocarditis is a very serious complication of pregnancy and is a frequent cause of sudden death during labor or early in the puerperium. When associated with chronic valvular lesions, it is usually the factor which gives rise to the most serious trouble.

Acute endocarditis.—This occurs as rarely during pregnancy as at other times. While it is always a very serious disease, it is even more so during gestation, for the reason that the fetus may die from infection due to the causative organisms, when the clinical course will be complicated by abortion or premature labor.

Asthma.—Asthma may be aggravated during pregnancy, or may make its appearance only at that time. Medical treatment and a change of climate usually lead to its relief.

Dyspnea.—Dyspnea occurring in the latter months of pregnancy as a result of the upward pressure of the enlarged uterus has already been referred to as a normal accompaniment of the condition, but its appearance in the early months is usually due to cardiac insufficiency and should lead to careful investigation.

Varicose veins.—These have already been discussed on page 97.

Edema.—Edema has been mentioned as a frequent complication of pregnancy, resulting from mechanical interference with the return of blood from the lower extremities. In other cases, it may be an early symptom of toxemia, and, for that reason, should always be called to the attention of the physician. If the urine and blood pressure are normal, the edema may be treated by posture and support, but when it is associated with renal insufficiency, the dietetic and medicinal measures recommended for the treatment of pre-eclamptic toxemia should be employed. Marked edema of the vulva, as pictured in Fig. 110, may be relieved by allowing the excess of serum to escape through a series of small aseptic puncture wounds. Care must be taken to avoid infection.

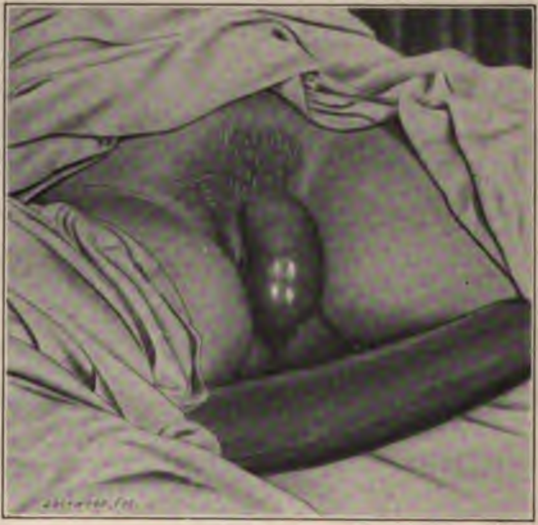


FIG. 110.—Edema of vulva. (Williams.)

DISEASES OF THE ALIMENTARY TRACT

Jaundice.—Jaundice may be a symptom of a severe derangement of the liver resulting from one of the toxemias of pregnancy, and such a possibility is so important that even a slight icterus should be given serious consideration.

Gall Stone Attacks.—These occasionally occur during pregnancy, but operation should be deferred until after labor, unless it is urgently necessary, when it should be done without regard to the existence of the pregnancy.

Salivation.—Salivation to a moderate degree is occasionally seen, but very rarely causes the patient serious annoyance, and rapidly disappears after delivery. Medicinal treatment is usually of no avail, but occasionally a rigid milk diet brings prompt relief.

Indigestion, Constipation and Flatulence.—These have been considered in an earlier section.

Appendicitis.—Appendicitis does not occur more commonly during gestation than at other times. The presence of the enlarged uterus renders diagnosis somewhat more difficult, but, when it has been made, prompt operation is necessary. Such interference considerably increases the probability of abortion or premature labor, especially if it is necessary to free dense adhesions.

DISEASES OF THE URINARY TRACT

Pyelitis.—Infection of the pelvis of the kidney is quite a frequent complication of pregnancy. It usually occurs in the later months and is somewhat more frequent in primiparae. The right kidney is more frequently involved, on account of the tendency for the head to engage in the right oblique diameter of the pelvis and thus compress the right ureter, where it crosses the brim of the pelvis. As a result, the urine is dammed back into the pelvis of the kidney, which is thus rendered susceptible to infection from bacteria brought to it by the blood or lymph, or by extension upward from the bladder. The colon bacillus is the usual infecting organism and gains access to the kidney through the lymph channels draining the neighboring intestine. If the bladder is not the primary source of the infection, it usually becomes involved secondarily.

The onset of the disease is acute, and is characterized by pain in the lumbar region, fever accompanied by chill, and frequent painful urination. Palpation in the renal region elicits acute pain, and may reveal an enlarged, tender kidney. Examination of a catheterized specimen of urine shows numerous pus cells, and bacteria can be demonstrated in suitably stained specimens. The condition is frequently mistaken for appendicitis and salpingitis, but in doubtful cases the diagnosis is established by the urinary findings.

Treatment consists in rest in bed, ordinary diet and the ingestion of large quantities of fluids, more particularly water. Urotropin 0.60

gram (10 grains) may be administered every four hours dissolved in a glass of water. When cystitis constitutes a prominent part of the clinical picture, bladder irrigations with boric acid or other mild antiseptic solutions may be of value. The reaction of the urine should be changed two or three times a week by the administration of acid or alkaline salts in sequence. The rationale of this procedure lies in the fact that most organisms are seriously affected by changes in the reaction of the medium in which they grow, and by frequent alterations in the character of the urine the bacteria concerned are not able to develop rapidly. If relief is not obtained within a few days, radical enthusiasts recommend that the ureter be catheterized and the kidney pelvis directly irrigated.

Fortunately, the medical treatment outlined is ordinarily followed by prompt subsidence of the symptoms and the remainder of the pregnancy is uneventful; although, occasionally, the first attack may be followed by others, which may be relieved in the same way. In rare instances, however, there is no response to conservative measures, and the patient becomes so ill that interruption of the pregnancy must be considered. This usually effects a cure unless it has been delayed so long that the infection has spread to the kidney substance and given rise to a *pyelonephritis*. If the urine becomes normal after the first attack, recurrences in subsequent pregnancies are uncommon. Consequently, the possibility of another pregnancy should be avoided, until the urine has been pronounced normal after repeated examinations.

Cystitis.—Unless associated with pyelitis, cystitis is quite uncommon. When it occurs as a primary condition, it must be promptly and energetically treated in order to prevent the involvement of the renal pelvis by its upward extension along the ureters. Treatment consists in bladder irrigations and instillations, together with the administration of urotropin or other urinary antiseptics.

Abnormal Urinary Constituents.—Certain substances may appear in the urine during pregnancy, which are not present normally. They may be of the utmost significance or possess no pathological importance.

Albumin.—In voided specimens, there can frequently be detected a faint trace of albumin, due to the presence of small amounts of vaginal secretion. On the other hand, in catheterized specimens, which are not thus contaminated, the faintest trace of albumin is significant. In the absence of pus, the albumin must come from the kidney, and is indicative of impaired renal function. In this event, the patient should be carefully followed to guard against the development of the various pregnancy toxemias, which will be considered in detail in the next chapter.

Casts.—The presence of casts of any type on microscopical examination signifies the existence of renal disease, and is therefore of considerable diagnostic importance.

Pus Cells.—Occasional pus cells from the vaginal secretion may be found in the voided urine, but their presence in great numbers, or in catheterized specimens indicates infection of the urinary tract—cystitis or pyelitis.

Blood.—The passage of bloody urine is always pathological and is usually indicative of a serious lesion of the urinary tract. Actual hematuria must not be confused with the accidental admixture of blood in voided specimens, as for example when the patient has a bloody vaginal discharge.

Bacteria.—For the study of bacteria in the urine, only catheterized specimens collected in sterile containers are of value. As urine is normally free from organisms, their presence proves the existence of an infectious process somewhere along the urinary tract.

Sugar.—Except in the presence of some unusual constituent, the usual tests for sugar in the urine give negative results. During pregnancy, lactose and glucose may be found, and, since their significance is so different, it is essential that they be differentiated. Lactose, as a rule, gives an atypical reaction with Fehling's or Benedict's solution and does not ferment in the presence of yeast, whereas glucose gives a definitely positive reaction and does ferment.

Lactosuria is frequently observed during pregnancy and lactation, and is directly attributable to activity of the mammary gland, which manufactures lactose from the glucose brought to it by the blood, and at times some of the former is passed back into the blood stream. The body is unable to utilize it, and it is excreted by the kidneys as rapidly as it is formed. It has no significance.

Glycosuria occurs more rarely and requires more careful study. In non-pregnant individuals, its detection ordinarily means the existence of diabetes, but in pregnancy it may appear in the absence of that disease. It seems that during gestation the kidney has a lower threshold for glucose than normally, so that sugar may appear in the urine following the ingestion of any considerable amount of carbohydrate. By regulating this amount, it can be made to disappear and does not persist after delivery. Consequently, it may be regarded as a trifling abnormality.

In patients with true diabetes, on the other hand, the condition had usually existed before the beginning of pregnancy and is associated with the usual symptoms of thirst, emaciation and dyspnea. Unless the condition is detected early and the diet carefully supervised, the outcome may be serious. In advanced cases, death in coma may occur during pregnancy or early in the puerperium; although, in milder cases, restriction of the carbohydrates in the diet may carry the patient along until the second half of gestation, when the fetal pancreas begins to function and so increases the mother's carbohydrate tolerance that she can enjoy an unrestricted diet without the appearance of sugar in the urine. Furthermore, during lactation, the transformation of large quantities of blood glucose into lactose by the breasts maintains a similar tolerance, but later, and particularly after the child has been weaned, the glycosuria returns, and careful dieting must be resumed as recommended in the various medical textbooks.

Floating Kidney.—The symptoms attending a movable kidney are diminished during pregnancy, as the enlarged uterus tends to retain the organ in its normal position; but they may become aggravated after delivery when the abdominal walls are relaxed. In this event, a supporting bandage should be worn.

DISEASES OF THE NERVOUS SYSTEM

Hysteria.—The nervous system tends to be more unstable during pregnancy than at other times, and it is therefore to be expected that functional disturbances, such as hysteria, should become increasingly frequent. Moreover, such manifestations are not uncommon during menstruation, and in both instances the loss of nervous balance may perhaps be attributed to some disturbance in the relation between the functions of the various glands of internal secretion.

Neuralgia.—Neuralgic pains in the lower extremities are frequently met with during the latter months of pregnancy, as the result of the pressure of the child's head upon the sacral nerves. If the head is not engaged, a well-fitted corset, which bears some of the weight of the enlarged uterus, may relieve the symptoms, but complete relief is rarely obtained until after delivery. Cramps in the legs are at times annoying; they may be relieved by firm extension of the foot at the ankle.

Neuritis.—A true neuritis, with tenderness along the nerves and shooting pains, is at times associated with the toxemias of pregnancy. It tends to disappear as the underlying condition is relieved.

Epilepsy.—Pregnancy may have a favorable effect upon epilepsy, in that the convulsive attacks are less frequent than at other times, but, during the puerperium and lactation period, the seizures tend to occur with increased frequency. Epileptic convulsions, occurring near the end of pregnancy or during labor, may be mistaken for eclampsia, but negative urinary findings and low blood pressure readings will exclude the latter. Treatment is the same as in the non-pregnant state, while the mother should not nurse her child for fear that it may be injured during a convulsion.

Epileptics should not marry, as their offspring are usually poorly equipped mentally and physically, and may likewise develop congenital epilepsy. Under the influence of the present movement to eliminate the unfit, it would not be surprising if the marriage of epileptics were made illegal, and, if the sterilization of adults affected with the disease were mandatory, its incidence would be greatly decreased.

Disturbances of Vision.—The more usual diseases of the eye are not affected by pregnancy, but temporary visual disturbances occasionally constitute one of the early signs of the toxemias, and, consequently, are of significance. Seeing "black specks" or "bright flashes" before the eyes is usually the earliest eye symptom, while, in more severe intoxications, the vision becomes so indistinct that the patient cannot count correctly the fingers held up for inspection, and, still later, there may be complete blindness. In general, it may be said that the visual disturbances accompanying eclampsia result from an edema of the retina, whereas in nephritic patients they are due to an albuminuric retinitis. Consequently, when the white patches, characteristic of the latter condition, are observed with the ophthalmoscope, an unqualified diagnosis of chronic nephritis can be made. As a rule, blindness due to edema disappears completely shortly after the causative toxemia has been relieved, whereas the nephritic lesions are more permanent in character.

DISEASES OF THE BLOOD AND SKIN

Pernicious Anemia, Leukemia and Hemophilia.—These diseases are so rarely associated with pregnancy that they need only be mentioned as possibilities. In the first-named disease, it is of interest that, even though the maternal blood is depleted of red cells to the danger point, the child presents a normal blood picture.

Lead Poisoning.—Lead poisoning is of importance as illustrating the bad effects of certain types of industrial work upon pregnant women and their children. Among women suffering from chronic lead poisoning, more than half the pregnancies end in abortion, and, of the small number of children who are born alive at term, only ten per cent reach the age of ten years. Moreover, many of the women thus affected are absolutely sterile, or have only a single child.

DISEASES OF THE SKIN

Practically all of the various skin diseases may appear during pregnancy and should be treated as in the non-pregnant state. There are no special skin ailments attributable to pregnancy, except the pigmentations and striations previously described.

DISEASES AND ABNORMALITIES OF THE GENERATIVE TRACT

Varicose Veins of the Vulva and Vagina.—Varicose veins of the vagina are very rare, but varicosities about the vulva are more common. Such varices are of importance only when very large, as their rupture during pregnancy or labor may cause serious hemorrhage. In this event, the bleeding is venous in character and can be controlled by pressure until the physician can ligate the torn vessel. Otherwise, treatment is unavailing, although the condition fortunately becomes much less annoying after delivery.

Bartholin's Gland Abscess.—Infection of Bartholin's glands is usually of gonorrheal origin and occasionally goes on to real abscess formation, when the labium majus on the affected side becomes enlarged and painful. More rarely, both glands are involved. The associated pain and discomfort, as well as the possibility that the abscess may rupture during labor, demand that it be treated surgically, whenever possible. Complete excision of the abscess cavity is the ideal procedure, but it is so frequently complicated by profuse bleeding, that many operators prefer to incise and drain the abscess during pregnancy, postponing its removal until sometime after delivery. It should be remembered that, as these patients have gonorrhea, the nurse should be careful to disinfect her hands after all treatments.

Carcinoma of the Cervix.—This is occasionally associated with pregnancy, having been present before conception or making its appearance at a later date. Pregnancy causes the tumor to grow more rapidly than at other times. Moreover, when the condition is advanced, the induration of the cervix may offer an insuperable obstacle to spontaneous labor. If operation offers a chance for cure, the fetus should be disregarded and complete hysterectomy performed as soon as the diagnosis is made, but, if the condition is inoperable, pregnancy should be allowed to proceed to term, when, if vaginal delivery is impossible, cesarean section should be done in the interests of the child.

Anteflexion of the Uterus.—Exaggeration of the normal anteflexion of the uterus has been mentioned as one of the earliest signs of pregnancy. In the latter months of gestation, particularly when the abdominal walls are very lax, the body of the uterus may sag forward, giving rise to the so-called pendulous abdomen. This produces severe dragging pains in the back and lower abdomen, which may be relieved by a properly fitted maternity corset. During labor, such patients should be kept in the recumbent position and the weakened abdominal muscles supported by a snugly fitted binder, so that the child's head may present at the superior strait.

Retrodisplacements of the Uterus.—These are commonly regarded as one of the chief causes of sterility, and, as has already been stated, they predispose to early spontaneous abortions, when pregnancy does occur.

When a fertilized ovum becomes implanted in a retroverted uterus, or when a pregnant uterus becomes retroverted, several eventualities are possible. If the uterus is not adherent, the displacement may undergo spontaneous reduction as the organ enlarges during the third or fourth month of gestation. In other cases, and especially when adhesions are present, this fails to occur. In this event, the constantly increasing size of the uterus causes such pressure against the walls of the pelvis, that uterine contractions set in and expel the fetus prematurely.

If pregnancy continues, the uterus may become *incarcerated* and give rise to various symptoms by its pressure on the neighboring organs, and radical operative treatment may be necessary to relieve the condition. In rare instances, necrosis of the bladder or rectum may result and lead to a fatal outcome. In other cases, the anterior wall of the uterus may hypertrophy to such an extent as to accommodate the entire product of conception, while the posterior wall remains adherent in the pelvis. In such cases of *sacculation of the uterus,* as it is called, great difficulty may be experienced at the time of labor, because the cervix is drawn up behind the symphysis and its spontaneous dilatation becomes impossible, so that surgical procedures are necessary to effect delivery.

The most characteristic symptom of retrodisplacement of the pregnant uterus is continued frequent and painful urination during the early months of gestation. The diagnosis is made by vaginal examination, when the displacement should be corrected by bimanual manipulation if possible. The uterus should then be maintained in its proper position by means of a pessary, until its body occupies the abdominal cavity, when recurrence is impossible. If reposition cannot be effected and the symptoms become threatening, it may become necessary to open the abdomen, separate the adhesions, and suspend the uterus by one of the methods in vogue.

Prolapse of the Pregnant Uterus.—A uterus, which has a tendency to prolapse, may protrude farther than usual from the vaginal orifice during the early months of pregnancy, but after the fourth month the attendant symptoms in large part disappear. Consequently, when the complication occurs, the uterus should be supported by a suitable pessary until the ascent of its body into the abdominal cavity does away with its necessity. In other cases, the hypertrophic and elongated cervix may protrude from the vulva, especially when the patient stands erect, so that it is liable to contamination by pathogenic bacteria, which may give rise to serious puerperal infection after delivery. This danger may be in great part obviated by keeping the patient in bed during the latter part of pregnancy.

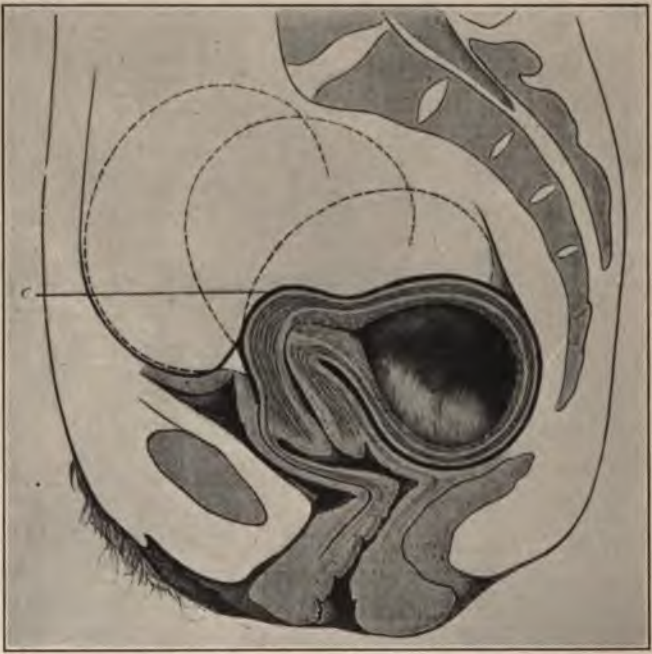


FIG. 111.—Retroverted pregnant uterus. Dotted lines indicate progress of spontaneous reduction. *c*–cervix. (Bumm.)

Hernia.—Pregnancy may occur in women with inguinal, femoral or umbilical hernia, but ordinarily is not affected thereby. On the other hand, the increased abdominal pressure produced by the enlarging uterus may increase the size of a hernial protrusion. As a rule, only palliative measures should be employed, and operation postponed until after delivery, as otherwise the constantly increasing pressure renders a recurrence almost certain. When, through negligence, the hernial contents become strangulated, operation must be resorted to in order to save the patient's life.

Endometritis.—Endometritis is generally associated with sterility, but when the inflammatory reaction is relatively mild, implantation of the ovum may not be interfered with. In this event, conditions are unfavorable for its continued development, and early abortion frequently occurs. The affection cannot be treated during gestation, but appropriate measures should be instituted after the pregnancy is ended.

Acute infection of the decidua may follow attempts at criminal abortion, may be associated with gonorrheal infection, or may develop as a result of a septicemia in the mother. Under these circumstances, the decidua becomes thickened and infiltrated with leukocytes, and the bacteria concerned can be demonstrated in its tissues. Severe infection is incompatible with prolonged fetal life, while in rare instances the bacteria may gain access to the blood vessels of the fetus and cause its death. Palliative measures can alone be employed, since active treatment will inevitably interrupt the pregnancy.

Pelvic Inflammatory Disease.—As a rule, pregnancy does not occur in women suffering from chronic infection of the tubes and ovaries, as in such conditions occlusion of the fimbriated end of the tube prevents the meeting of the ovum and the spermatozoa. Should pregnancy, however, occur, the probability that the fertilized ovum may be arrested in its passage down the tube is greatly increased, and in such an event a tubal pregnancy develops. If normal uterine pregnancy occurs, the adjacent structures become stretched as the uterus grows and give rise to pain in the lower abdomen, for which there is practically no relief. Occasionally, a chronic inflammatory process may undergo exacerbation during gestation. In most cases, rest, the local application of ice-caps, and eliminative measures are all that is necessary. If a pelvic abscess forms, it must be opened and drained by vaginal puncture; but if general peritonitis develops, laparotomy offers the only possibility of cure.

Myoma of the Uterus.—Patients with uterine myomata are relatively sterile, so that this complication is not encountered more than once in every two hundred pregnancies. Moreover, the changes in the endometrium associated with it tend to early abortion. The presence of myomata in a pregnant uterus does not demand interference unless annoying pressure symptoms develop. The effect of myomata upon the course of labor will be considered later.

Ovarian Tumors.—Tumors of the ovary, when associated with pregnancy, frequently lead to abortion in the early months, or cause serious accidents later. Consequently, if diagnosticated before the last month of pregnancy, the tumor should be removed by laparotomy. When the patient is not seen until the time of labor, the procedure will vary according as the tumor obstructs the birth canal or not. In the former contingency, it is removed through an abdominal incision followed by the delivery of the child by cesarean section; otherwise its removal is postponed until later in the puerperium.

Pregnancy Following Operations.—The more usual pelvic operations have no deleterious effects upon subsequent pregnancies, although occasionally the premature expulsion of the fetus may result from conditions produced thereby. More frequently, the alterations in the anatomical relations of the organs may give rise to difficulties during labor, which will be discussed later.

Operations During Pregnancy.—In general, pregnant women stand operative procedures extremely well, but, in view of the danger of provocating premature expulsion of the fetus, surgeons prefer to avoid intervention, except when postponement is fraught with so great a risk as to make an abortion relatively insignificant. The danger of abortion is accentuated whenever the pelvic viscera must be manipulated; although, on the other hand, fibroid nodules may frequently be removed from the uterus without disturbing the pregnancy. In the individual case it is impossible to predict what the effect may be, as it is dependent upon an absolutely unknown factor—the irritability of the uterus.

CHAPTER XIV

THE TOXEMIAS OF PREGNANCY

General Considerations.—The term "toxemia of pregnancy" is a general one, and embraces several abnormal conditions, which occur only in parturient women, and are supposedly due to the action of toxins derived from the product of conception. The *early* and the *late* toxemias are differentiated as separate groups, as each has such different clinical and pathological findings, that it is hard to imagine that they are due to the same poison.

Clinically, the early toxemias are associated with digestive disturbances, whereas those occurring later are accompanied by symptoms referable to kidney insufficiency. There are, in addition, certain rare manifestations of a toxic nature, which form a further group of no little interest.

THE EARLY TOXEMIAS

It has already been stated that the usual nausea and vomiting of early pregnancy may be looked upon as the result of a mild auto-intoxication, but that the nervous condition of the patient likewise plays an important rôle. These symptoms appear in approximately one-half of all pregnancies, but ordinarily do not interfere seriously with the patient's nutrition, and disappear spontaneously. Occasionally, however, they become progressively worse, until no food is retained, and the patient rapidly loses weight and strength. The condition is then designated as *pernicious vomiting* and constitutes the typical early toxemia.

PERNICIOUS VOMITING

Pernicious vomiting appears once in every several hundred pregnancies, and may be regarded as an exaggeration of the so-called physiological morning sickness. It manifests itself during the first four months of gestation and is more common among neurotic individuals.

While it is not possible to assign a definite etiology to pernicious vomiting, it may be assumed that it is based upon the mild intoxication incident to pregnancy. Attempts to explain further why this toxin occasionally produces such serious disturbances have led to the recognition of two types of the disease—the neurotic and the toxemic. Thus, either of the two factors cited as playing a part in the production of morning sickness may dominate the clinical picture.

Neurotic Vomiting.—In this, the much larger group, the nervous equilibrium of the patient is essentially unstable, and the appearance of morning sickness rapidly leads to a neurasthenic breakdown of the powers of nervous resistance. The vomiting soon becomes uncontrolled and within a few days the patient may appear desperately ill. The fact that such patients respond promptly to measures similar to those employed in the treatment of other neurasthenic conditions serves to substantiate their neurotic origin.

Toxemic Vomiting.—By contrast, in very rare instances, it seems that the normal protective mechanism against the assumed toxin is ineffective, with the result that the system is rapidly overwhelmed by the poison. The patient, thus affected with a true toxemic vomiting, shows no neurotic taint, and the suggestive treatment, so effective in the other group, is of no avail, while the only course which will definitely arrest the disease consists in the removal of the ovum, whereby the source of the toxin is eliminated.

Pathology.—In the neurotic type of vomiting, there is no specific pathological lesion. The patients may, if neglected, die from starvation, but post-mortem examination will reveal only a pronounced general emaciation.

Toxemic vomiting, on the other hand, is associated with characteristic liver lesions and with secondary degenerative changes in the kidneys. The former are of the greatest importance and consist in a pronounced cell necrosis in the central portion of the liver lobule, while its periphery remains normal. Similarly localized cell destruction occurs in acute yellow atrophy of the liver, as well as in poisoning by phosphorus or chloroform, but in eclampsia the lesion is quite different, as it is largely confined to the peripheral cells of the lobules.

Symptoms.—Vomiting is the essential symptom. In an established case all attempts at eating or drinking are followed by the ejection of the ingested material, and at times large quantities of acid fluid may be vomited, even though nothing has been swallowed for some hours. There is, as a rule, nothing peculiar about the vomitus, which consists of the ingested and partly digested food, although in the later stages of toxemic vomiting, coffee-ground vomitus is ejected without effort, and is always a grave sign.

The urine is scanty and highly colored, as a result of the limited fluid intake, and usually contains a trace of albumin, as well as hyaline and granular casts.

The blood pressure and temperature are normal, while the pulse varies, being normal in most instances, but occasionally it is markedly accelerated and poor in quality.

Clinical Course.—The inability to retain nourishment leads to a rapid and pronounced loss of weight and strength. In the later stages of toxemic vomiting, general toxic symptoms appear, and the patient may become drowsy or maniacal, before lapsing into the coma, which ends in death. Convulsions and other nervous phenomena occasionally appear near the end.

In most cases, under appropriate treatment, the digestive tract becomes more tolerant of food and recovery is rapid. It is very unusual for the symptoms to recur later in pregnancy, and, fortunately, the occurence of pernicious vomiting in early pregnancy does not predispose to eclampsia.

Diagnosis.—All especially severe cases of vomiting may be looked upon as pernicious, in the sense that they actually endanger the patient's health, if not her life. If such a diagnosis leads to the early institution of conservative measures to control the symptoms, it cannot be criticized, but is very reprehensible when it leads to the indiscriminate induction of abortion. In view of the neurotic tendency in so many women presenting this complication, too much confidence must not be placed in their statements regarding the severity of the symptoms.

Differentiation between the two types, neurotic and toxemic, is essential to reasonable therapy, since the former can be cured without interference with the pregnancy, whereas, in the true toxemic type, only early therapeutic abortion will save the life of the patient.

Fortunately, the latter condition is very rare, so that it is not reasonable to destroy the pregnancy in all cases of serious vomiting, in order to be sure of saving the few women with the toxemic type. There is no absolute method for determining with which group one has to deal, but practically the therapeutic test is the most useful. For this purpose all cases are considered as neurotic, until a thorough trial of the suggestive treatment, to be detailed later, has failed to check the vomiting. Such a procedure entails only a slightly increased risk in the true toxemic type, and obviates many unnecessary abortions in the neurotic type. If, after a few days treatment along these lines, marked improvement does not occur, steps are at once taken to empty the uterus, in the belief that we have to deal with a true intoxication.

It was formerly thought that chemical examination of the urine furnished a positive means of differentiation, and it was taught that the vomiting was toxemic in origin, if the percentage of urinary nitrogen excreted in the form of ammonia was much increased above the normal of five per cent. Subsequently, however, it was shown that a similar alteration develops during starvation, and, consequently, the diagnostic value of the high ammonia coefficient was seriously impaired. At present it is considered that this determination is of value only when the percentage of ammonia is low, for, under such circumstances, both starvation and a toxemia can be definitely excluded.

Statements to the effect that a continuously rapid pulse (over 100 per minute), is indicative of a true toxemia, are not in accord with clinical experience, although such a condition indicates that the patient is seriously ill.

Prognosis.—The prognosis in pernicious vomiting depends largely upon the etiology of the condition; the neurotic cases can be cured by conservative measures, whereas a certain number of the toxemic cases will die, even in spite of the induction of therapeutic abortion. In the latter group, the ultimate result will depend upon whether the uterus has been emptied before the destruction of the liver cells has become so extensive as to be incompatible with life.

Treatment.—Prophylaxis is most important, but is of limited practical value, since most pregnant women look upon nausea and vomiting as a normal accompaniment of their condition and do not appeal for aid until the symptoms have become alarming. Many potential cases of pernicious vomiting can be relieved by attention to the diet and bowels as suggested in an earlier chapter. If this is not effective, or if, as more usually happens, the patient does not seek relief until the symptoms have become uncontrollable more elaborate measures must be instituted.

In the first place, a competent nurse should be secured, to carry out the treatment, and particularly to protect the patient from the well-meant but harmful sympathy of her family, who should be practically excluded from the sick room. For the first few days, nothing, not even water, is given by mouth, while the fluid necessary to prevent excessive thirst is introduced by rectum. Tap water is perfectly satisfactory for this purpose, but one per cent glucose solution or predigested liquid nutriment may be substituted. Salt solution has no advantages, as the absorption of the salt leads to an increased thirst. The rectal administration of fluid is generally better borne, if the drop method is employed, instead of the introduction of relatively large quantities at intervals. By using the smallest rubber catheter and permitting a flow of 40 to 60 drops per minute for periods of two hours, four times daily, sufficient fluid for the body's needs can usually be given without seriously irritating the rectal mucosa. Before beginning such treatment, and once daily during its continuance, a soap-suds enema should be given to cleanse the lower bowel and thus promote absorption through its mucosa.

If the vomiting ceases, the administration of liquids by mouth may be begun after two or three days. It is essential that the patient express a definite desire for whatever is offered and that it be given in very small quantities. As the amount of fluid taken by mouth increases, that given by rectum is correspondingly reduced. Such a reduction in the rectal feeding has a beneficial psychological result, in that the patient is encouraged to take as much by mouth as possible, in order to avoid the annoyance of the rectal tube. After several days of liquid diet, with no return of the nausea, solid food may be given. It is most effective to withhold all solids, until the patient expresses a desire for them, when it is agreed that she may have whatever she chooses, with the understanding that the recurrence of vomiting will necessitate the reinstitution of rectal feeding. In one such case, in my experience, chocolate candy, and, in another, beefsteak, represented the first solid food the patient had taken in more than a week, and in both instances there was no recurrence of the symptoms.

In the more obstinate cases, it may be necessary to remove the patient to a hospital, so that isolation may be more complete. A separate room is preferable, and all visitors, including the family, are excluded for a few days. In addition to the treatment just described, gastric lavage is performed after each vomiting attack. The stomach is washed out with large quantities of warm tap water, or a weak (one per cent) solution of sodium bicarbonate, and the patient is cautioned that it will be repeated after each attack. This promise is faithfully kept, with the idea of substituting a distinctly disagreeable but harmless impression in place of the sympathy, which was formerly forthcoming whenever vomiting occurred.

Occasionally, even this does not have the desired effect, and hypodermoclysis is added. The long, sterile infusion needle is inserted well under the breast without preliminary anesthetization of the skin, and 500 cubic centimeters of normal salt solution are rapidly introduced. The accumulation of fluid in the tissues is decidedly uncomfortable and its physical effects persist for some hours. The patient is again threatened with a repetition of the treatment if the vomiting does not cease.

In the usual neurotic case, the symptoms will disappear following such a course of annoying and suggestive procedures. If, however, they still persist, the diagnosis of toxemic vomiting is made and the induction of abortion is resorted to.

It is not claimed that such treatment is specific, for it must be clearly understood that its effect is largely psychic, but the results obtained are quite remarkable. Other procedures making a similar suggestive appeal will undoubtedly be equally effective. After the vomiting has definitely ceased, the immediate family may be readmitted for short periods, but others are excluded until it is felt that the cure is established.

From time to time, various remedies have been advocated as specific in the treatment of pernicious vomiting, but the fact that they have enjoyed only short periods of popularity indicates that they were not so efficient as their originators claimed. Many of them, such as applications to and dilatation of the cervix, or electrical treatments, probably accomplished their results by the same appeal to the mind as the procedures here recommended. Drugs have, likewise, been given in great numbers, but their administration is now generally discredited. The latest therapeutic suggestion is the hypodermic injection of corpus luteum extract, which certain obstetricians claim results in a large percentage of cures. The repeated injections undoubtedly have a psychic effect upon the nervous patient, and it is difficult to determine whether the results are attributable to it or to a definite therapeutic action. While it is conceivable that the symptoms may be referable to a disturbance in the internal secretory function of the ovary, no satisfactory proof of such an etiology has yet been adduced.

As has already been stated, immediate induction of abortion is indicated, as soon as it has been determined by exclusion that we are dealing with toxemic vomiting. The method employed for emptying the uterus will vary with the condition of the cervix; if it is long and rigid, vaginal hysterotomy is preferred, but if it is short and patulous, dilatation and curettage is the method of choice. It is essential that some other anesthetic than chloroform be employed, as it has been demonstrated that it may produce the same liver lesions as the toxin causing the vomiting, and it is reprehensible to do anything which may accentuate the condition. Postoperative treatment should follow the general lines laid down for patients who recover under purely medical treatment, with a gradual return to mouth feeding as the symptoms disappear.

THE LATE TOXEMIAS

Under this heading, various toxic conditions are grouped together on the basis of a similarity in their clinical manifestations. It appears that the ovum does not produce this particular toxin in sufficiently large quantities to give rise to symptoms, until after the middle of pregnancy, and, as toxemic conditions become increasingly frequent as term is approached, it seems permissible to assume that the formation of the poison is roughly proportional to the size of the fetus.

Moreover, from the frequency of such disturbances, it seems probable that the supposititious toxin is a normal product of gestation, which is ordinarily rendered innocuous by some specific protective mechanism, or is so rapidly eliminated by the kidneys that its concentration never becomes dangerous. In this event, a defect in either line of defense would lead to the production of a toxemia.

It will be seen that eclampsia accords well with the former, and nephritic toxemia with the latter, possibility. These two diseases, however, form a so-called vicious circle, with the consequent obscuring of the initial defect. In eclampsia, the unneutralized toxin temporarily damages the kidneys and thus introduces the clinical picture of renal insufficiency, whereas, in chronic nephritis, the reduced permeability of the kidneys allows the toxin to pile up in the body to such an extent that it cannot be effectively neutralized. Eclampsia and nephritic toxemia represent the most serious of the late toxemias, and are usually preceded by a milder premonitory condition designated as pre-eclamptic toxemia.

PRE-ECLAMPTIC TOXEMIA

This relatively frequent complication is characterized, in general, by the presence of albuminuria, high blood pressure, edema, and headache. Its symptoms rarely appear before the middle of pregnancy and are more commonly encountered as term is approached. They tend to become progressively worse, and may terminate in coma and convulsions, followed by death. Pre-eclamptic toxemia occurs several times in each one hundred pregnancies, and thus furnishes one of the most serious problems with which the obstetrician has to deal. The diagnosis is usually made from the symptom-complex, and it is often difficult to decide whether the condition is primarily pre-eclamptic in nature, or is based upon a mild nephritis. From the standpoint of immediate treatment, this is immaterial, but a reasonably accurate differentiation can usually be made after careful study of the individual patient. True pre-eclamptic toxemia usually confers a relative immunity, so that a return in subsequent pregnancies is quite unlikely, whereas, in the nephritic type, the renal changes tend to become more severe as time goes on and to cause more alarming manifestations in each succeeding gestation.

Symptoms.—The symptoms of greatest importance are albuminuria, high blood pressure, edema and headache, and their appearance during pregnancy always demands the closest attention. The urine, in addition to varying quantities of albumin, contains casts of various kinds, and the twenty-four hour output is usually below normal. In severe cases, almost complete anuria may occur. The blood pressure may rise suddenly from a normal of under 130 millimeters to the neighborhood of 200 millimeters, or it may increase slowly to the same point.

Pressure edema of the feet and ankles, resulting from interference with the return of blood, must not be confused with swelling resulting from renal insufficiency. In the former event, there is no accompanying increase of blood pressure and no albuminuria, but if they are present the condition is probably pathological in nature and demands attention. On the other hand, even slight edema of the face, hands or lower abdominal wall is always significant.

Headache in pre-eclamptic toxemia is usually localized in the frontal region and may be very persistent. In the more severe grades of intoxication, there may be violent epigastric pain, while visual disturbances, varying from slight indistinctness of vision to total blindness, are very characteristic. Nothing is known concerning the cause of the former symptom, but the latter are referable to conditions in the retina. In the true pre-eclamptic condition, this structure shows a marked edema and there may be small areas of hemorrhage, while, in nephritic toxemia, similar changes may likewise be present, but, in addition, there is frequently an exudation of white material forming patches of varying size —*albuminuric retinitis*. As this latter abnormality is characteristic of chronic nephritis, its detection makes possible the diagnosis of that disease, whereas the presence of retinal edema and hemorrhage is not pathognomonic.

If the toxemia is not relieved by suitable treatment, it may lead either to uremic coma, or to a typical eclampsia with its characteristic general convulsions. In either event, as a result of the maternal intoxication, the fetus may perish *in utero* and be born later in a more or less macerated condition.

Diagnosis.—The diagnosis of pre-eclamptic toxemia is made whenever any of the symptoms just described persist for any length of time. A single severe headache or a transient edema are obviously of little importance, while a trace of albumin in a voided specimen of urine or a moderate rise of blood pressure merely demand further observation.

It is often impossible to differentiate between the eclamptic and nephritic types of the disease except by repeated examinations after the subsidence of the more acute symptoms. Persistence of the symptoms for more than three weeks after delivery usually means that the kidneys are permanently damaged. A history of similar attacks in previous pregnancies furnishes presumptive evidence that the patient has a chronic nephritis, whereas, if she is a primipara, who has previously enjoyed good health, the supposition is that the disturbance is pre-eclamptic in nature. In general, it may be said that the latter is more common in first pregnancies, and nephritic toxemia in later gestations and in older individuals.

Treatment.—Treatment of the condition naturally resolves itself into two phases—prophylactic and curative.

Prophylactic.—One of the chief functions of routine prenatal care, as outlined in a previous chapter, is the early detection of these conditions and the prompt institution of proper treatment. Under ideal conditions many cases can be recognized in their incipiency and can be controlled by a suitable régime to such an extent that the danger to the life of the mother and child is largely averted. Consequently, the appearance of any degree of albuminuria, or an increase of blood pressure, with edema and headache, calls for more constant supervision and for the inauguration of a simple régime. In such early cases with mild symptoms, it usually suffices to increase the fluid intake, to insure regular evacuation of the bowels and to insist upon a diet relatively low in protein and salt.

Curative.—If, in spite of such precautions, the symptoms become worse, and, particularly, if the albumin content of the urine exceeds one gram per liter, or the blood pressure rises above 150 millimeters, more energetic measures must be adopted. Such patients should preferably be in a hospital, where adequate facilities for treatment and nursing are available.

The central idea in the treatment of pre-eclamptic toxemia is to encourage elimination in every possible way, which theory is based upon the assumption that a toxin is responsible for the symptoms, as well as upon the fact that clinical experience shows that such procedures usually lead to their amelioration. Diuresis, catharsis and venesection aim to rid the body of the toxin already present, while emptying the uterus removes the source of its supply. The dietary régime, by decreasing the amount of metabolic end-products which must pass through the kidneys, promotes the excretion of other materials, among which is the poison.

Diuresis.—Diuresis increases the urinary output and removes the excess fluid present in the body in the form of edema. Water is the most effective diuretic and should be forced throughout the entire course of treatment; its monotony may be broken by the use of mineral waters, lemonade, orange juice and weak tea. The total daily amount of ingested fluid should not fall below three quarts. Likewise, fluids are frequently administered by rectum, sometimes by the drop method, but more commonly as large colonic irrigations, but possess no particular advantage when the patient is willing to drink.

Catharsis.—The bowels should be kept well open, and to increase elimination by this channel, saline cathartics are employed and repeated as indicated. Epsom salts, Rochelle salts and magnesium citrate are usually chosen because they produce watery stools by drawing the body fluids into the intestine.

Sweating.—The skin is an important excretory organ and should be kept in good condition. A daily warm bed bath will ordinarily suffice, but great care must be taken to avoid chilling the body. The bedclothing should be sufficient to keep the patient comfortably warm at all times, and exposure must be reduced to a minimum. Profuse sweating is sometimes promoted by the use of hot, dry or wet, packs, but this practice is gradually falling into disuse. The theoretical objection to it is that, since the perspiration contains little but water, profuse sweating only reduces its amount in the body, and hereby may concentrate the toxins in the circulation.

Venesection.—Venesection furnishes the most direct method of eliminating the toxin, but is ordinarily reserved until simpler methods have failed to relieve the symptoms. An arm vein is cut or punctured with a large-bore needle under aseptic precautions and 500 to 1000 cubic centimeters of blood are withdrawn. The blood pressure is closely followed while the blood is flowing, and the bleeding is stopped if it falls below 130 millimeters. Patients with a constantly low pressure should not be bled, since collapse may follow the attempt. Occasionally venesection brings permanent relief, but more commonly the improvement is only temporary. Even this may be of great importance since it postpones the induction of labor for some days or weeks and thereby gives the child a better chance of survival.

Diet.—A restricted diet is universally recommended, but opinions differ as to what foods may be allowed. An exclusive milk diet (two or three quarts of whole milk daily) has many advocates, and, if well borne, seems to have only beneficial effects. It has, however, a very high protein content and, therefore, places a rather heavy excretory burden upon the kidneys, which already have more work than they can properly do, and therefore should be spared as much as possible. To accomplish this, it has recently been suggested that a low-protein and salt-poor diet should be given. It is as yet too early to determine whether the results are better than with the older method, but at least they seem to be no worse. Moreover, the diet is more in accord with the modern views of dietetics as applied to renal disease.

If such treatment is followed by gradual improvement, more radical procedures may be held in abeyance, but if no change occurs after two or three days, particularly if the albumin increases in amount and the blood pressure rises in spite of it, the induction of labor must be considered. Great haste is usually not necessary in these patients and the more conservative measures (bougie or bag) will prove satisfactory. Unless some urgent indication for operative interference arises, labor is allowed to proceed spontaneously, and, if an anesthetic is required, ether or gas and oxygen is administered, rather than chloroform.

Prognosis.—Pre-eclamptic toxemia is not in itself a fatal disease, and never leads to the death of the mother, although the fetus may perish *in utero*. Its seriousness is due to the fact that it may be a forerunner of nephritic coma or of true eclampsia, both of which rank high as causes of death among parturient women. Accordingly, effective prognosis must deal with the probability of the development of these more serious conditions, and is by no means easy. In general, slow development of the symptoms is a good sign, as it indicates a mild toxemia. Daily determinations of the amount of albumin in the urine and of the blood pressure afford the best index as to the progress of the disease. If they improve under treatment, it is probable that the toxemia will not prove dangerous, whereas, if they become progressively higher, the patient should be considered as in great danger, and it may become a question whether the uterus can be emptied promptly enough to forestall the appearance of coma or convulsions.

Prognostications concerning the possible danger of a recurrence of toxemia in subsequent pregnancies is based upon the completeness of the disappearance of the signs of renal insufficiency after delivery. Following confinement, weekly examinations are made over a period of several months. If the albumin completely disappears and the blood pressure returns to normal during this interval, it is relatively safe to predict that the condition is unlikely to return in the course of future pregnancies. On the other hand, the continued presence of even the faintest trace of albumin and a few casts or the maintenance of a higher blood pressure than is normal for the age of the patient indicates that she is suffering from chronic nephritis, and that in all probability the toxic symptoms will reappear under the strain of another gestation. Unfortunately, the various kidney function tests (phenolsulphonephthalein excretion, blood urea determinations, etc.) rarely give useful information in such conditions except in well marked cases of chronic nephritis. Furthermore, it appears that certain patients have so mild a grade of nephritis that there is no evidence of its existence in the intervals between pregnancies, and yet shortly after a new conception definite signs reappear. This condition is usually quite amenable to treatment and runs a mild course, but becomes more noticeable in each succeeding pregnancy.

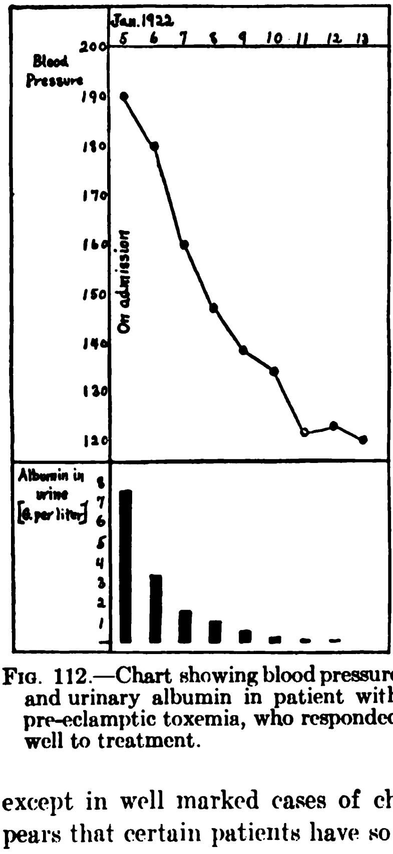


FIG. 112.—Chart showing blood pressure and urinary albumin in patient with pre-eclamptic toxemia, who responded well to treatment.

NEPHRITIC TOXEMIA

The milder forms of chronic renal disease complicating pregnancy were considered in the previous section and their general treatment was discussed. In many instances the severity of the symptoms increases only slowly, so that it is frequently possible to carry the patient along under careful supervision until the child has attained viability. When that point has been reached, even though the condition is unchanged, labor should be induced in order to avoid further damage to the kidneys.

Occasionally the patient's condition becomes rapidly worse and she passes into a state of coma, which may or may not be accompanied by convulsions. More radical treatment is then instituted along the lines to be discussed under the treatment of eclampsia. Death may occur during the coma, or there may be slow recovery, with more or less complete disappearance of the symptoms, depending upon the severity of the initial lesion.

Women suffering from a well defined chronic nephritis, before conception, may present alarming symptoms during the first few months of pregnancy, and rapidly become worse. In such cases, the albuminuria increases from week to week, while the blood pressure steadily rises until it often exceeds 200 millimeters, and the subjective symptoms become very annoying. Continuation of the pregnancy is clearly out of the question, and the uterus must be emptied with complete disregard for the infant, in order to save the life of the patient.

When it is remembered that the condition is almost certain to recur in all subsequent pregnancies, it is evident that temporary measures are of little real value. If the patient is young and has no living children, it may be decided to induce abortion, in the hope that, after a period of careful medical treatment, a second pregnancy may proceed more favorably. Such compromises are rarely successful, for in addition to the danger of a fatal outcome for the mother, the fetus is likely to succumb, since chronic nephritis ranks next to syphilis as a cause of fetal death.

In multiparous women with one or more living children, the problem is still more clear-cut, and there should be no hesitation in treating them radically. Moreover, there is a growing feeling that sterilization should be effected at the time the abortion is performed, so that the patient's life should not again be placed in jeopardy. For this purpose the uterus is emptied by an abdominal hysterotomy, and, before the wound is closed, both fallopian tubes are divided and their cut ends buried in the folds of the broad ligaments. As this procedure renders it impossible for the spermatozoa to reach the ova or for the ova to reach the uterine cavity, the patient is effectively sterilized, and it is believed that by eliminating possible exacerbations of the chronic renal process incident to repeated gestations, such treatment undoubtedly serves to prolong the patient's life.

When there are religious objections to the interruption of pregnancy, strictly medical measures must be employed in the hope that the mother can withstand the strain until the fetus dies and is spontaneously expelled. It must be admitted that it is extremely difficult to estimate the actual danger to life in such cases, and physicians are sometimes surprised at the resistance shown to a condition which was thought to be incompatible with continued pregnancy.

In this connection, it is very important to inform a woman with evident chronic nephritis, who considers marriage, of the probable dangers of child-bearing, so that she may realize the risk involved.

ECLAMPSIA

Eclampsia is an acute disease, presumably of toxic origin, which occurs during pregnancy, labor or the puerperium, is characterized by severe necrosis of the liver, and is usually associated with general convulsions and coma.

Although it occurs only about once in 500 pregnancies, eclampsia constitutes nearly one per cent of the cases treated in maternity hospitals, since many patients, who would otherwise be delivered at home, are admitted after convulsions have developed. Various unknown factors influence its frequency, so that marked variations in incidence occur from year to year.

The disease very rarely appears during the first half of pregnancy, but is encountered more and more frequently as term is approached. Primiparous women are more commonly affected than multiparae—approximately in the ratio of 3 to 1. Multiple pregnancy and hydramnios likewise seem to predispose to it. Usually a longer or shorter period of definite pre-eclamptic toxemia precedes the outbreak of the disease, but occasionally the convulsions occur in women, who were apparently in excellent health and had no premonitory symptoms.

According to the time of the appearance of the first convulsion, three varieties of eclampsia are differentiated—***ante-partum, intra-partum*** and *post-partum.* As will be seen later, this distinction has some bearing upon the treatment and prognosis, but the clinical and pathological manifestations are identical. The first two groups comprise about three-quarters of the cases, so that only one case in four occurs after delivery.

It is sometimes difficult to differentiate between ante- and intrapartum eclampsia, especially when it has been preceded by severe pre-eclamptic toxemia and the possibility of the onset of labor has not been considered. The distinction is, however, of little importance, as it has no bearing upon the treatment to be pursued.

Pathology.—The essential lesion in eclampsia is characteristic and consists in a localized necrosis of the liver in association with a thrombosis of branches of the portal vein. The cell destruction is typically limited to the periphery of the liver lobule, but may become more generalized in very severe cases. For comparison, it will be recalled that in toxemic vomiting and acute yellow atrophy of the liver, as well as in phosphorus and chloroform poisoning, the lesion is confined to the central zone of the lobule, and therefore may easily be distinguished from that present in eclampsia. In addition, as might be expected from the urinary evidence of renal insufficiency, there is a more or less profound degeneration of the kidneys, but the consensus of opinion is that such changes are only secondary. Edema and hyperemia of the brain are frequently present and may explain the convulsions and other nervous phenomena. In practically all cases, there is likewise a certain amount of myocardial degeneration, probably the direct result of the toxin. The immediate cause of death is usually acute edema of the lungs or cerebral apoplexy; but when death occurs several days after the onset, it is more commonly due to pneumonia or puerperal infection.

The etiology of eclampsia is unknown; very many theories have been advanced, but none is supported by sufficient evidence to make it attractive. For our purpose, it is assumed that eclampsia represents an extension of the toxic manifestations of pre-eclamptic toxemia, in which the body's protective mechanism is so deficient that the system is overwhelmed.

Symptoms.—The symptoms of pre-eclamptic toxemia (albuminuria, elevated blood pressure, edema, headache, epigastric pain and visual disturbances) have already been discussed in some detail. Clinically, this condition merges into frank eclampsia when convulsions occur.

Convulsions.—Eclamptic convulsions are general in distribution and clonic in character, so that twitchings of all the skeletal muscles mark the seizure. The first sign of an approaching attack is a fixed staring expression of the eyes, which soon roll toward one side. Convulsive movements now appear at one corner of the mouth, spread rapidly over the entire face and soon involve the whole body. During the attack breathing is either entirely suspended by reason of a spasm of the throat, or the respirations are very rapid and shallow. In either event, the blood is insufficiently aerated and a progressive cyanosis results, which is relieved only when deep noisy respirations follow the cessation of the attack. There may be profuse foaming at the mouth and the tongue is frequently bitten. The patient is unconscious during the convulsion and remains comatose for a shorter or longer period after its termination.

The frequency and severity of the convulsive attacks show marked variation. Occasionally, there is only a single slight convulsion, but more frequently there is a greater number—often as many as ten or twenty, and rarely as many as one hundred, or even more. The individual attacks last from a few seconds to two minutes, while the succeeding coma may persist for five minutes or for an indefinite period, when consciousness is not regained between the convulsions. The interval between the separate convulsions varies equally greatly; at times they are several hours apart, and again they may follow one another so closely as to appear almost continuous. When a definite time interval has become established, as frequently happens, it tends to remain constant until a change in the patient's condition occurs; an increasingly long interval indicates improvement and the reverse a more gloomy outlook.

Blood Pressure.—The blood pressure is usually elevated, but occasionally remains quite normal throughout. During the actual convulsion it generally rises considerably above the pre-convulsive level, but rapidly returns to it. From the prognostic point of view this latter level is the most important and rarely exceeds 200 millimeters. Occasionally, extremely high blood pressure readings are noted (220 to 280 millimeters or more), as in chronic nephritis, but no hard-and-fast diagnosis can be made on such grounds.

Albuminuria.—Albuminuria with casts is an almost constant finding and is of value in the differential diagnosis between eclampsia and other conditions leading to convulsive attacks. Usually the urine is loaded with albumin, and quantitative estimations by the Esbach method may run from 1 or 2 grams per liter to as high as 40 or 50. When the albumin content exceeds 7 grams per liter, the urine becomes solid upon boiling. Very rarely, the urine shows no albumin until after the attacks have ceased, when faint traces may be detected. Casts of all kinds are commonly present and blood cells may be found.

Edema.—Edema is a frequent but not invariable symptom, and may be very extensive in its distribution. In some of the most severe cases it may be absent, but no general rule to this effect can safely be formulated.

Headache and Epigastric Pain.—These symptoms are very commonly complained of during the conscious periods, but because of the lessened sensibility to pain following the prolonged loss of consciousness, they never dominate the clinical picture as they may in pre-eclamptic toxemia.

Disturbances of Vision.—Temporary visual disturbances, due to edema of and hemorrhage into the retina are frequent. Usually there is only an indistinctness or blurring of the sight, but rarely total blindness is present for some time.

Pulse.—The pulse is ordinarily full and bounding, but tends to become rapid, weak and thready in the severe cases as the end approaches. This change is probably coincident with the progressive degeneration of the heart muscle.

Fever.—Pre-eclamptic toxemia is not accompanied by fever, but, after convulsions occur, there is a tendency for the temperature to become markedly elevated. It may reach 105° F. (per rectum) and the patient still recover, while in fatal cases temperatures of 107 to 109 degrees are not uncommon. A high fever generally indicates a gloomy prognosis, but promptly falls if recovery is to occur. It is believed that the reaction is due to the effect of the eclamptic poison upon the heat-regulating centers in the brain. At the same time, the peripheral mechanism for the maintenance of a constant body temperature, through perspiration and evaporation, is seriously at fault, as is evidenced by the extreme dryness of the skin.

Diagnosis.—Whenever convulsions occur during pregnancy or labor or early in the puerperium, the condition is commonly designated as eclampsia. While such a diagnosis is usually correct, it should be remembered that similar manifestations may appear in the course of uremic coma or in association with epilepsy or hysteria. During life, nephritis can only be differentiated clinically by the detection of an albuminuric retinitis, as all the other signs and symptoms may be identical. In epileptics, the history of previous similar attacks before conception is very important, and, moreover, the convulsions are the only symptom in common with eclampsia. In hysteria, the attacks are usually atypical in some particular and are not followed by coma, while, in addition, the urinary and blood pressure findings are normal. In very rare instances, the patient may die in coma without having had a single convulsion, and at autopsy the characteristic lesions of eclampsia be found. This "eclampsia without convulsions," as it is called, probably represents a fulminating toxemia, and can be diagnosticated only by post-mortem examination.

Clinical Course.—In ante-partum eclampsia, labor usually sets in shortly after the first convulsion, and, if left alone, may progress even more rapidly than usual to a spontaneous termination. The convulsions generally cease soon after the birth of the child. Moreover, if the fetus dies before labor begins, recovery is usually prompt and the patient may not fall into labor until some days later when the dead macerated fetus will be expelled. Intra-partum eclampsia does not materially affect the course of labor, and the birth of the child may be followed by the cessation of the attacks. On the other hand, the course of post-partum eclampsia depends entirely upon the response to the treatment instituted. This last type usually appears immediately after the completion of labor, but may be delayed for as long as twenty-four hours.

In favorable cases, as a result of delivery or of the treatment employed, the intensity of the symptoms gradually diminishes, and, after the coma has disappeared, recovery is prompt, unless some late complication develops.

In the absence of pulmonary or uterine infection, convalescence is accompanied by the complete disappearance of all clinical signs within ten to fourteen days. The urine and blood pressure become normal, the edema is absorbed and the subjective symptoms disappear, which is in distinct contrast to what occurs in uremic coma, where recovery is slower, and where the permanent kidney lesions result in the persistence of the various signs of renal insufficiency.

In the immediately fatal cases delivery has no appreciable effect upon the toxemia, so that the coma deepens, the convulsions become more severe and frequent, and death finally ensues within forty-eight hours from acute pulmonary edema or from cerebral hemorrhage.

Prognosis.—The maternal mortality from eclampsia is always high and averages about twenty per cent in hospital practice, and is undoubtedly much higher under the less favorable conditions prevailing in the home. With its allied conditions it is responsible for about twenty per cent of the deaths occurring each year among parturient women in the United States.

It is generally believed that post-partum eclampsia offers the most gloomy prognosis, but the difference from the other types is probably slight.

The unborn fetus is likewise placed in jeopardy by the maternal intoxication and from one-third to one-half are born dead, while certain others perish during the first days of life. In the latter event, the child may be somnolent and have general convulsions, and typical eclamptic lesions may be discovered in the liver at post-mortem examination. The fetal death rate is higher when the disease occurs before full term, since the more premature the child, the less able is it to resist the effects of the toxin.

Although it is extremely difficult to predict the outcome in any individual case, certain signs are of prognostic value. Thus, when the intervals between the convulsions are becoming shorter and the coma of longer duration, the outlook is bad, and the same may be said of a weak, rapid pulse or an excessively high temperature. Likewise, complete suppression of the urine with absence of perspiration is a bad sign, while the appearance of pulmonary edema or of cerebral apoplexy usually means that the end is near.

One of the few good things which may be said about the disease is that it ordinarily confers a relative immunity for the future, so that, if recovery takes place, the condition will probably not recur during subsequent pregnancies, and, if it does, it may be regarded as *prima facie* evidence that the original attack was not eclamptic in nature, but was a manifestation of a chronic nephritis.

Treatment.—The high mortality indicates that the therapy of the condition is not satisfactory, but this is not to be wondered at when it is remembered that its etiology is unknown. Certain more or less empirical procedures, which have been dictated by experience, go to make up the present line of attack.

Prophylactic.—The prophylactic treatment consists of the widespread institution of routine prenatal urine and blood pressure examinations, so that the very earliest stages of pre-eclamptic toxemia may be recognized and treated according to the principles laid down in a previous section. Even the most careful supervision will not always prevent the occurrence of the disease, but it will reduce the danger to a minimum, and its adoption has led to the saving of many lives each year.

Curative.—It is generally agreed that elimination of the toxin is the most reasonable method of treatment, and that the most effective single means to that end is the removal of the fetus. In spite of this agreement, there is great divergence of opinion concerning the details of the application of the principles involved. The more modern school advocates emptying the uterus only as a last resort, and only after other measures have failed to give relief, whereas the older practice was to effect delivery first and to encourage elimination afterwards. The former is known as the conservative method and is becoming more popular, as it is realized that both its immediate and ultimate results are better. The latter more radical method frequently involves considerable shock and rather extensive tissue damage, which probably prejudice the patient's chance of recovery. It is encouraging that all who have tried the newer method have become its staunch supporters.

Conservative Treatment.—Venesection forms the basis for conservative treatment and is supported by diuresis, catharsis and sweating, and at times by the administration of large doses of morphin or chloral. Delivery is postponed as long as possible and usually occurs spontaneously or is completed by a relatively simple operation after the cervix is well dilated.

Venesection.—From 500 to 1000 cubic centimeters of blood are withdrawn, as described in a previous section. No attempt is made to return an equal amount of salt solution, since it is recognized that the volume of the circulating blood will be quickly restored by the abstraction of plasma from the tissues. It frequently leads to permanent cessation of the convulsive attacks, and the patient, if already in labor, goes on to spontaneous delivery within a few hours. More rarely, in the ante-partum cases, the patient is relieved from all toxic symptoms, but does not fall into labor, so that the child is born normally some days later.

Diuresis.—Diuresis is promoted by forcing fluids; by mouth if the patient is conscious, or by the introduction of salt solution subcutaneously or of tap water by rectum, if she is unconscious. Hot applications over the lumbar regions may help the kidneys to perform their proper function. Drugs apparently do more harm than good, and in consequence should not be employed.

Catharsis.—A large dose of a saline purgative is given by mouth or by stomach tube, and in rare instances is supplemented by one or two drops of croton oil dissolved in olive oil and placed far back upon the tongue.

Sweating.—Profuse sweating was formerly employed as a routine, but its effects are so uncertain and the theoretical objections to its use so clear, that it is rarely used at present. The patient should, however, be kept well covered and protected from drafts.

Morphin.—Large doses of morphin are administered hypodermatically in an endeavor to reduce the reaction to outside stimuli and thus to prevent convulsions. Eclamptic patients have a remarkable tolerance for the drug, so that the usual dose is one-half grain (30 milligrams), repeated at hourly or two-hourly intervals, until the respirations are lowered to twelve per minute. Frequently it is necessary to give two or three grains (130 to 200 milligrams) before this is accomplished. The mother rarely shows any bad effect from such heroic treatment; but if the drug is given shortly before delivery, the child may be severely narcotized at birth, and may not cry well for some hours. In general, it may be said that the most promising field for the use of morphin is in patients who have a low blood pressure, and who, therefore, cannot be bled in safety.

Chloral.—Chloral in doses of 30 to 60 grains (2 to 4 grams) may be given by rectum to supplement the morphin, or quite independently, for the same purpose. The latter is, however, usually preferred when a hypnotic drug is indicated, since its administration is easier and its dosage more accurately regulated.

Veratrum Viride.—The fluid extract of veratrum viride is sometimes given by intramuscular injection in doses of 5 to 10 minims (0.3 to 0.6 cubic centimeter) until the pulse falls to about sixty per minute. One such injection may be sufficient, or the desired effect may be obtained only after two or three doses. The drug is used on purely empirical grounds, and as it appears to do no good, its use is being abandoned.

Attempts to Control Convulsions.—As the eclamptic convulsion is merely a symptom of the general toxemia, it seems illogical to treat it except by attacking the underlying condition. In spite of this, it has long been customary to attempt to control the seizures by the inhalation of chloroform. Its use, however, is distinctly contra-indicated for two reasons: first, as ordinarily employed, after the convulsion has actually started, it is quite useless, for practically no air is entering the lungs through the spastic glottis, so that not enough of the drug can be absorbed to have any effect; and second, if it were absorbed, it would tend to cause necrosis of the liver, and thus materially aggravate the condition of the patient.

On the other hand, it is a matter of experience that the convulsions frequently follow loud noises or disturbing treatments and examinations, and may be less frequent and less severe, if such exciting causes are eliminated. For this purpose, a quiet, darkened room is preferable, and all manipulations are reduced to a minimum consistent with proper care. Some physicians even give light gas-oxygen, or ether anesthesia, whenever anything must be done, which might disturb the patient.

Delivery.—In those cases, which respond most satisfactorily to the conservative method of treatment, the patient completely recovers from the intoxication before labor starts, and an uncomplicated delivery takes place some days or weeks later. This outcome is only possible in antepartum cases and is relatively uncommon. More frequently, labor is in progress when the first convulsion occurs, or begins shortly afterward and continues normally. As soon as the cervix becomes fully dilated or easily dilatable, artificial delivery is accomplished by the simplest possible procedure.

In rare instances, there is no improvement under treatment, and labor is either not inaugurated or much delayed. Under such circumstances, delivery is urgently indicated, in the hope of saving the patient's life. With the cervix only slightly opened, forcible manual dilatation is attended by so much shock and such extensive laceration of the pelvic tissues, that it is not justified when conditions permit a cutting operation. If the child is small, vaginal hysterotomy is usually the most feasible procedure, but if the pregnancy has advanced nearly to term, abdominal cesarean section is the operation of choice. The routine employment of the latter operation is open to considerable objection, since the presence of the uterine scar complicates succeeding pregnancies, which might otherwise be normal. Moreover, the operation has a definite mortality which is added to the already high death rate of the eclampsia itself. Fortunately, as confidence in the conservative treatment grows, the need for radical interference becomes very rare. Ether or gas-oxygen anesthesia should be employed rather than chloroform. When the patient is deeply comatose little of anything is needed.

Bleeding is so beneficial for these patients that the post-partum loss of considerable quantities of blood is encouraged, unless contra-indicated by an existing anemia. As a rule, though, even with no attempts to control the uterus, the hemorrhage is unusually slight and may be quite negligible.

The Radical Method.—The essential thing in the radical treatment is delivery as soon as possible after the first convulsion. The condition of the birth passages again dictates the choice of operation according to the statements already made. Following delivery, eliminative procedures are instituted as described.

The results obtained are distinctly less satisfactory than with the more conservative treatment. The great disadvantage appears to be that the shock of the operative delivery comes at the time when the toxemia is the most intense and the cumulative effect works to the detriment of the patient. Opponents of the radical method insist that the beneficial results obtained are attributable not so much to the removal of the fetus as to the blood lost during the operation, and that equally good results can be obtained by venesection.

Nursing Care.—Caring for an eclamptic patient is very strenuous work, and the nurse thus engaged should have no other duties. It should not be necessary for her to leave the bed-side even for an instant. All needed supplies should be brought to her. Conscientious efforts to carry out the usual treatment will require at least one person's undivided attention.

The bed should be made up as usual, except that it is well to provide a full-sized piece of rubber sheeting to protect the mattress. Coverings must be comfortably warm and should be carefully tucked in on all sides. Not infrequently, especially in cold weather, sheets are dispensed with, and soft woolen blankets are used in their stead. A pillow is not necessary while the patient is unconscious. There should be a curved basin with a mouth gag and a supply of gauze wipes conveniently placed near the head of the bed. (A wooden clothes pin thickly wrapped with gauze makes an excellent and inexpensive gag.) Other supplies are brought to the room only when needed. The window shades are drawn or a dim light is arranged so as not to shine in the patient's face. All movements are made as quietly as possible.

When a convulsion occurs, the mouth gag is introduced between the back teeth on one side to prevent biting the tongue and cheeks. False teeth should be removed and care taken that decayed teeth are not damaged by the necessary manipulations. The gag may be removed as soon as the convulsion has ceased and the froth around the mouth and nose carefully wiped away. Nothing else is necessary at the time.

Forcing water to increase general elimination is one of the most important things in the treatment of eclampsia. When a patient is completely unconscious it is not advisable to introduce anything by mouth, and salt solution must be given by infusion or tap water by stomach tube or by rectum. The swallowing reflex is present, however, in all semiconscious patients and by persistent effort considerable water may be given by mouth. At first small bits of ice can be placed in the mouth as rapidly as they melt and are swallowed. Later, water is given from a teaspoon, and finally from a regulation feeder. The only way to learn whether water will be swallowed is to try it from time to time, and to make a business of giving as much as possible once the reflex is established.

Since the outcome in a case of eclampsia is rarely in doubt for more than forty-eight hours, no attempt is made to feed the patient during the acute stage of the illness. The short fast thus entailed undoubtedly does more good than harm.

The pulse is counted at the temporal artery in front of the ear rather than at the wrist, since the latter necessitates a certain amount of undesirable disturbance. The temperature should be taken by axilla or by rectum, but should not be attempted by mouth.

During all manipulations, care should be taken to prevent exposure and to disturb the patient as little as possible.

In cases occurring before delivery, the nurse should be on the lookout for signs of labor. Except in the most extreme degrees of coma, uterine pains are associated with regular, short periods of increased restlessness. When such an observation is made, the hand should be placed over the abdomen to determine whether the movements correspond to the contractions of the uterus. Slight vaginal bleeding likewise indicates that labor has begun. As soon as it is certain that labor is in progress, preparations should be made for delivery and the perineum should be inspected at frequent intervals, so that the doctor may be called in time to conduct the birth. It is very embarrassing to find that the child has already been born when labor was not even suspected, and the error occasionally proves fatal to the infant, who may be drowned by the amniotic fluid or blood.

Eclampsia apparently lowers the patient's resistance to infection and requires that special care be taken to preserve the most rigid asepsis during examinations and at the time of delivery, as well as in the course of infusions, venesections and hypodermic injections.

At times eclamptic patients become very restless and even maniacal, so that it is necessary to utilize a canvas strait-jacket to keep them in bed. For the milder cases, it may suffice to attach heavy canvas sides to the bed. With these aids, one nurse can usually manage all except the most violent patients, without assistance.

Involuntary voiding and stools are of frequent occurrence and it is advisable to place a thick absorbent pad under the patient's buttocks, so that the entire bed may not be soiled at each such accident.

The more common nursing procedures are conducted as usual, and the details will not be dwelt upon in this place.

OTHER TOXIC DISTURBANCES

In this group are placed several rare conditions, which are supposedly of toxic origin. They are of very infrequent occurrence and are included merely to complete the picture of the pregnancy toxemias.

Acute Yellow Atrophy of the Liver.—This is a rare disease of toxic origin associated with necroses in the central portions of the liver lobules, which result in a rapid diminution in the size of that organ. It may occur in men or non-pregnant women, but more than half the cases appear as a complication of late pregnancy or the early puerperium. Clinically, the symptoms are so similar to those of eclampsia, that it is frequently mistaken for the latter condition. The chief points of difference are the appearance of jaundice and a demonstrable decrease in the area of liver dullness in the atrophic cases.

Treatment consists in the prompt removal of the fetus and determined efforts to promote elimination according to the principles outlined in previous sections. The prognosis is extremely poor and the majority of cases end fatally.

Presumable Toxemias.—Moderate degrees of mental derangement designated as *pregnancy psychoses* occasionally appear during the course of a pre-eclamptic condition and are referred to the action of the toxin. The usual toxic treatment is quite effective.

Other peculiar manifestations of a mild auto-intoxication, such as *peripheral neuritis, excessive salivation* in the early months of pregnancy, and certain *skin diseases,* especially *herpes,* are benefited by an eliminative and dietary régime and completely disappear after delivery.

CHAPTER XV

HEMORRHAGE

General Considerations.—Profuse bleeding from the uterus is always a serious, and sometimes a fatal, complication in obstetrical practice. It may occur before the birth of the child—*ante-partum hemorrhage*, immediately after delivery—*post-partum hemorrhage*, or later in the puerperium—*puerperal hemorrhage.*

Pregnant women are peculiarly tolerant of losses of blood and may show no symptoms following a hemorrhage which would be serious for the ordinary individual. With continued bleeding, however, a point is eventually reached, where symptoms of shock become manifest and carry the threat of a fatal outcome. In such cases, the general management is comparable to that employed in surgical practice and consists primarily in control of the hemorrhage, combined with supportive measures.

Ante-Partum Hemorrhage.—Hemorrhage occurring before the onset or during the course of labor, is usually due either to lacerations of the genital tract or to separation of the placenta from its attachment on the wall of the uterus. In the latter event, it is designated as *accidental,* when the normally implanted placenta becomes separated, or as *unavoidable,* when the placenta is situated in the immediate neighborhood of the internal os, so that its attachments must be broken as soon as the cervix begins to dilate—*placenta previa.*

Hemorrhage is spoken of as *external,* when the blood escapes through the external os, and as *concealed,* when it is retained within the uterine cavity. In placenta previa, the bleeding is always external in character, whereas that resulting from lacerations and premature separation of the placenta may be either external or concealed, or both.

PREMATURE SEPARATION OF THE PLACENTA

Premature separation of the normally implanted placenta occurs in one-half to one per cent of all pregnancies, but assumes serious proportions much less commonly. Although it is more frequently observed in multiparae and its occurrence is directly proportional to the number of preceding pregnancies, the more severe cases are more common in primiparous women. In about one-half of the cases, there are no clinical signs, and the diagnosis is made only by examination of the afterbirth. As the accident is associated with external hemorrhage in about ninety per cent of the cases, the more serious concealed hemorrhage occurs but rarely.

Pathology.—The separation of the placenta may be either partial or complete and the resulting bleeding either external or concealed. Partial separation with external hemorrhage is the most common combination and fortunately the least dangerous. The process is inaugurated by the unexplained rupture of small vessels beneath the placenta, whereby blood escapes into the tissues and produces a hematoma. Unless the torn vessels are effectively compressed by the developing clot, the hematoma slowly increases in size, and, in so doing, splits the decidua along the line of least resistance. This usually takes place toward one edge of the placenta and later extends between the membranes and the uterine wall, so that the blood finally escapes through the external os. In the rare cases of concealed hemorrhage, the membranes do not peel off so easily, and the retroplacental hematoma so increases in size that the placenta becomes detached and the uterine walls become distended by the accumulated blood. Occasionally, it escapes into the amniotic cavity through a rent in the membranes, but more usually a passage is eventually dissected through the decidua vera and a part of the blood escapes from the cervix.

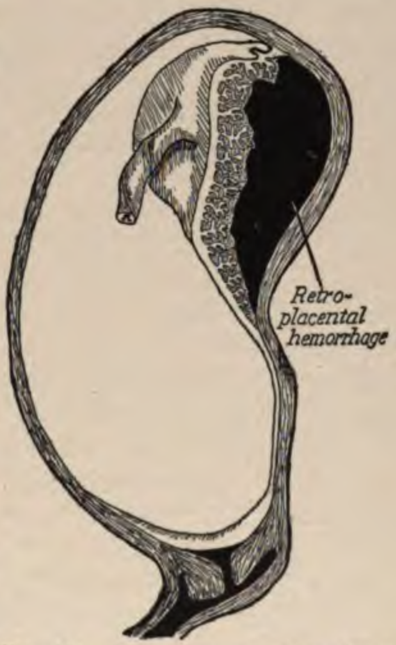


Fig. 113.—Premature separation of normally implanted placenta—concealed and external hemorrhage. (Diagrammatic.)

It should be remembered that the bleeding tends to continue until the uterus is emptied of its contents and is able to contract down upon and thus compress the bleeding vessels. The developing hematoma compresses the adjacent placental tissue, and, by interfering with the circulation through its villi, renders it functionless. When the area of compression and separation is extensive, the fetus receives a deficient supply of oxygen and finally dies from asphyxiation.

In most cases of premature separation, there are no demonstrable lesions in the uterus, and the only evidence of its occurrence is afforded by the presence of a depressed area on the maternal surface of the afterbirth corresponding to the location of the clot. In the more severe cases, characteristic changes develop in the uterine wall, which are designated as *uteroplacental apoplexy.* In this, the extravasation of blood involves the muscular wall of the uterus as well as the decidua, and the organ presents a purplish, congested appearance throughout. This is associated with such disassociation of the muscle fibers that the uterus cannot contract satisfactorily after it has been emptied. In such circumstances, fatal atonic bleeding may result unless the organ is quickly extirpated.

Etiology.—The primary cause of premature separation must be sought in the mode of production of the initial break in the decidual vessels. The frequent association of the condition with toxemic manifestations lends support to the theory that a suppositious toxin renders the vessel walls more permeable and friable than normal, and thus predisposes to their rupture. On the other hand, roughly half of the patients exhibit no symptoms of toxemia, and it is difficult to believe that this constitutes the sole factor. Others are inclined to attribute the accident to an unusual torsion of the uterus about its longitudinal axis, which leads to such extreme engorgement of the uterine and decidual vessels that they finally give way. It may be said, however, that the proof adduced in its support is not convincing.

At the time of labor, purely mechanical factors occasionally produce the condition; for example, an abnormally short umbilical cord may drag the placenta from its attachment, or the sudden decrease in the size of the uterus following the birth of the first of two twins, or the release of a large quantity of fluid in hydramnios, may lead to premature separation of the placenta by diminishing the area of its attachment.

Clinical Course and Symptoms.—Premature separation of the placenta may occur during the latter months of pregnancy or at the time of labor. In the former event, uterine contractions usually set in shortly after the bleeding commences. The course of events depends entirely upon the severity of the hemorrhage.

Vaginal bleeding is almost invariably present, for, even when the hemorrhage is concealed, a portion of the blood usually escapes through the cervix. As a rule, the bleeding is slow and persistent in character, and not in sudden gushes or "floodings," such as occur in placenta previa.

Individual reaction to the loss of blood is so variable that no definite statement can be made concerning the appearance of symptoms of shock. The slow, steady loss of blood associated with the accident usually leads to a rather gradual development of shock, with its well-known symptoms —weak, rapid pulse, low blood pressure, paleness of the mucous membranes, shortness of breath and cold, moist skin. Loss of consciousness is rare except just before death.

If the bleeding is entirely external, the uterus behaves as in a normal labor; but if large quantities of blood are retained within its cavity, the organ enlarges somewhat under the increased pressure and becomes tense and hard. When palpated through the abdominal wall, it presents a characteristic boardlike feel, without alternation between contraction and relaxation. Under these conditions, the fetus cannot be palpated, nor its heart sounds heard.

In the presence of concealed hemorrhage, intense and continuous abdominal pain is characteristic, and, in many cases, directs the attention of the physician to the possibility of the accident. In other cases, localized discomfort, other than that associated with the uterine contractions, is unusual.

In many patients examination of the urine will show moderate albuminuria with casts, a finding which lends support to the toxemic theory of its causation.

Diagnosis.—In the presence of vaginal bleeding, premature separation must be differentiated from placenta previa and rupture of the uterus. If the examining finger can detect no placental tissue near the internal os, placenta previa can be eliminated, while in rupture of the uterus, the recession of the presenting part and the unusual ease with which the fetus can be palpated through the abdominal wall will ordinarily establish the diagnosis.

When the hemorrhage is concealed, the accident frequently will not be suspected until signs of shock appear or until the patient complains of severe, constant abdominal pain. But as soon as its possibility is considered, the boardlike consistency of the uterus will serve to establish the diagnosis, as well as to differentiate the condition from rupture of an advanced ectopic pregnancy or a spontaneous rupture of the uterus.

Prognosis.—The immediate outcome depends upon the amount of blood lost. Fortunately, in most cases of external bleeding, the hemorrhage is rarely excessive, and recovery is the rule. Concealed accidental hemorrhage, on the other hand, is a most serious complication, which, if not treated radically, results in the death of about half the mothers and practically all the children. Delivery does not terminate the danger, since fatal post-partum hemorrhage may occur from the atonic uterus.

Treatment.—The general principle underlying the treatment of premature separation consists in measures to control the bleeding and to combat its effects.

When the loss of blood is slight and the patient's condition good, labor is allowed to proceed spontaneously, although, in some instances, a Voorhees bag is introduced to hasten the dilatation of the cervix.

On the other hand, the appearance of shock, whether the bleeding is external or concealed, calls for immediate emptying of the uterus by the most conservative procedure. If the cervix is partially dilated and soft, manual dilatation, followed by version and extraction, is preferred, whereas, if it is hard and unyielding, cesarean section is the operation of choice, which is followed by amputation of the uterus, if the organ remains atonic in spite of suitable stimulation. During and after operation, the existing shock should be combated by salt solution given subcutaneously or intravenously, and, in the most urgent cases, by blood transfusion. Stimulants, such as strychnin, camphor, ether, and caffeine should be administered hypodermatically, and coffee given by rectum. The patient is kept warm with extra blankets, supplemented by hot water bottles or electric pads, and the foot of the bed is elevated.

After delivery, the occurrence of post-partum hemorrhage must be guarded against. Excessive bleeding calls for the prompt introduction of a uterine pack, and, if this fails to have the desired effect, the only recourse is to remove the uterus. Fortunately, the necessity for so radical a procedure is limited almost entirely to the relatively infrequent cases with uteroplacental apoplexy.

PLACENTA PREVIA

This term literally means that the placenta presents in front of the child. In other words, it is attached in the region of the internal os.

Depending upon the completeness with which the placental tissue covers the internal os, three varieties of the condition are recognized: *central* or *complete, partial,* and *marginal placenta previa.* In the first, the placenta completely covers the fully dilated cervix; in the second, it encroaches upon, but does not completely cover the internal os; while in the third variety, its lower edge just reaches the margin of the dilated cervix, but does not overlap it. (See Figs. 114, 115, 116.) Such differentiation cannot satisfactorily be established until the cervix has become fully dilated, because the marginal variety cannot be felt by the examining finger until it has occurred, and because what may appear as a complete placenta previa when the internal os is small may prove to be only partial after dilatation is complete.

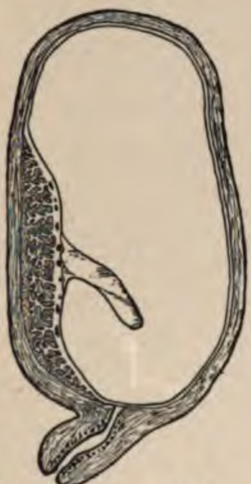


FIG. 114.—Marginal placenta previa. (Diagrammatic.)

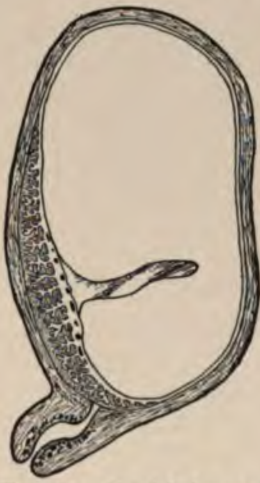


FIG. 115.—Partial placenta previa. (Diagrammatic.)

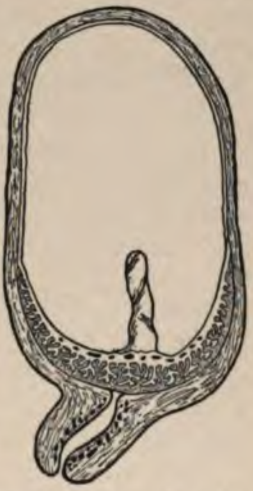


FIG. 116.—Complete placenta previa. (Diagrammatic.)

In the central and lateral varieties, partial separation of the placenta is inevitable during the dilatation of the cervix, and necessarily involves the rupture of the blood vessels supplying the separated portion, so that the resulting hemorrhage is really *unavoidable.* Moreover, it cannot satisfactorily be controlled until the uterus has been emptied and is able to contract down upon and compress the bleeding vessels. With the marginal variety, on the other hand, hemorrhage may not occur, since the placental tissue barely reaches the fully dilated os, and may not become detached until the end of the second stage of labor.

Placenta previa is the most common cause of serious ante-partum hemorrhage and occurs about once in 500 cases, although its hospital incidence is much greater. The partial variety is most frequently observed, while complete placenta previa is relatively infrequent; although, in all probability, the marginal type would rank first, were it possible to include the cases which give rise to no symptoms. The condition occurs rarely in primiparae, but increases in frequency with the number of previous pregnancies.

Etiology.—According to our present conception, placenta previa results from a defective blood supply in the early decidua, resulting from inflammatory or atrophic changes. It is believed that the fertilized ovum becomes imbedded in the usual manner, but as the placenta expands in its search for maternal blood vessels to furnish nourishment for the growing fetus, it finds a scanty supply in the abnormal decidua, and consequently is obliged to spread out more widely than usual, and in so doing it occasionally approaches to or covers the internal os of the cervix. Support is lent to such a view by the fact that the afterbirth in placenta previa is frequently much larger and thinner than usual.

Symptoms.—Unavoidable external hemorrhage is the only symptom of placenta previa, and ordinarily occurs during the last three months of pregnancy or at the time of labor, when the changes in the lower uterine segment and cervix are taking place, although it is probable that certain early abortions may be due to the abnormality.

The hemorrhage frequently appears without warning and is not associated with pain. It may occur while the patient is asleep. As a rule, the initial bleeding ceases spontaneously, only to recur within a few hours or days, although, in rare instances, it may be so severe as to lead to a fatal issue within a few hours. In general, the hemorrhage is more severe in the central and lateral varieties than in the marginal. In the former, it usually begins several weeks before labor is expected, while in the latter it may appear only after the onset of labor.

The presence of the placenta in the lower portion of the uterine cavity interferes with the usual accommodation of the fetus, so that such abnormal presentations as breech and transverse are more frequent than usual.

The liability to post-partum hemorrhage is distinctly increased for two reasons: first, that difficulty may be experienced in the detachment of the spread-out placenta, which may necessitate its manual removal; and second, that the flabby tissues of the lower uterine segment are unable to contract sufficiently to compress effectively the bleeding vessels.

Diagnosis.—Placenta previa can be diagnosticated only by the actual palpation of placental tissue in the neighborhood of the internal os. If the cervical canal is sufficiently wide to admit the examining finger, it can readily distinguish the characteristic sponge-like placenta from other structures. In ante-partum hemorrhage associated with premature separation of the normally implanted placenta, or with rupture of the uterus, no such structure can be felt. The variety of the abnormality can only be determined after the cervix is nearly fully dilated.

Prognosis.—The prognosis is always serious, but with the introduction of modern methods of treatment the incidence of fatal cases has been remarkably reduced. Under the treatment formerly in vogue, about one-third of the mothers perished, whereas at present in well conducted hospitals the death rate is under five per cent. Death may result directly from hemorrhage, or, later, from puerperal infection, to which patients weakened by the loss of blood are especially susceptible.

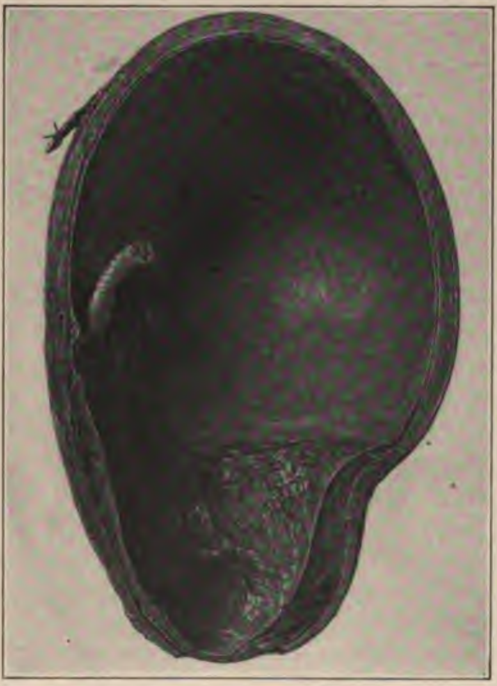


Fig. 117.—Complete placenta previa. (Drawing from specimen in the J. H. H. Obstetrical Museum.)

For various reasons, the fetal mortality has remained high in spite of the improvements in treatment. This is largely due to the fact that the accident usually occurs several weeks or months before term, so that the premature children are likely to die during, or shortly after, birth. To the high death rate due to this cause must be added the dangers incurred during operative delivery, as well as the possibility of intrauterine asphyxiation, resulting from the placental hemorrhage. When these facts are taken into consideration, it is not strange that more than half the children are lost.

Treatment.—Once the diagnosis of placenta previa has been made, pregnancy should be terminated by the most conservative means as soon as possible, because of the ever-present danger of severe or even fatal hemorrhage. Ordinarily, this is best accomplished by some method which prevents further bleeding and at the same time stimulates the uterus to expel its contents. For this purpose several procedures have been devised, the earliest of which was suggested by Braxton-Hicks and is known by his name. In it, the child is turned by means of two fingers introduced through the cervix, aided by abdominal manipulation with the other hand. A foot is drawn down into the vagina, and traction is made until the buttocks compress the placenta against the uterine wall and thus check the bleeding; delivery, however, is not attempted, until the cervix has become sufficiently dilated to permit the passage of the fetal head. This method gives excellent maternal results, but, since it almost invariably leads to the death of the fetus, its employment is reserved for cases outside the hospital.

In hospital practice, the use of the conical rubber bag (the Champetier de Ribes balloon or the Voorhees bag) enables us to obtain equally good maternal results without greatly increasing the danger to the child. The collapsed bag is introduced into the uterine cavity, and afterwards expanded to its full extent with sterile water. By attaching a small weight to the tube by which the bag terminates, and allowing it to hang over the foot of the bed, traction is exerted, which serves the double purpose of checking the bleeding and at the same time hastening the dilatation of the cervix. As soon as the latter is fully dilated, the child is delivered by the quickest and safest procedure—usually version and extraction.

Packing the cervix and vagina tightly with gauze is likewise advocated, but should be regarded merely as a temporary expedient; for, while it may check the external loss of blood, hemorrhage may go on behind it.

Instrumental or manual dilatation of the cervix, in order to effect more rapid delivery, has in great part been abandoned, as it is associated with great danger of extensive laceration of the cervix and lower uterine segment. This is particularly likely to occur in placenta previa, as these tissues have become unusually friable as a result of their invasion by the fetal elements of the placenta, and of the increased blood supply incident to the condition.

Cesarean section may occasionally be indicated in primiparous patients, whose cervix is too rigid to permit the insertion of a bag. Except under these rare circumstances, it is not a reasonable procedure, since it gives no better results than the more conservative methods of treatment, while the scar in the uterus may seriously complicate subsequent pregnancies. The argument that the operation is justified in the interest of the child has no weight, unless the pregnancy has advanced nearly to term.

If there is no excessive bleeding following delivery of the child, the third stage should be conducted as usual and the placenta expressed only after it has separated spontaneously; but, if the hemorrhage is profuse, it should be expressed promptly by the Credé method, or, if this fails, it must be removed manually. Post-partum hemorrhage is not infrequent, and, consequently, materials should always be at hand for packing the uterus at a moment's notice; while in some cases a uterine pack may be introduced as a prophylactic measure.

The existence of shock calls for the usual remedies, and, if it is pronounced when the patient is first seen, it may be advisable to undertake its relief before proceeding to terminate the pregnancy.

POST-PARTUM HEMORRHAGE

A certain amount of bleeding from the uterus is an almost inevitable accompaniment of the separation of the placenta during the third stage of labor. Six hundred cubic centimeters (20 ounces) has been arbitrarily set as the upper limit for the normal loss, and bleeding in excess of it is designated as *post-partum hemorrhage.* Unless the amount of blood lost has been actually measured, it is frequently underestimated, when the diagnosis is not made until the patient shows unmistakable signs of an acute hemorrhage. Judged by the above arbitrary standard, roughly ten per cent of all patients delivered at term will have some degree of post-partum hemorrhage, although not more than one per cent will show signs of exsanguination, and a fatal outcome should occur only once in several thousand labors.

Etiology.—Excessive bleeding may occur during or after the third stage of labor, from various causes. When occurring before the placenta has been expelled, it is usually due to partial separation of that organ, but occasionally results from lacerations in the birth canal.

As long as the placenta is completely attached, bleeding cannot occur, but during the normal process of gradual separation, blood always escapes from the torn vessels of the decidua. As soon as separation is complete, the placenta is pushed into the lower uterine segment and vagina, and the torn vessels are constricted by contraction and retraction of the uterine muscle. Ordinarily, the process of separation is so rapid that the amount of blood lost does not exceed the normal limit, but abnormalities in its mechanism may unduly prolong the process and lead to profuse hemorrhage. Consequently, improper management of the third stage, with unnecessary massage of the uterus or too early attempts at expression, is the most frequent cause of faulty and delayed separation. Occasionally, the placenta may be more widely attached or more intimately adherent than usual, so that its detachment occurs imperfectly. Fortunately, hemorrhage from such partial separation is usually not serious, since it ceases promptly as soon as complete detachment is effected. The bleeding in these cases usually occurs in gushes synchronous with the contractions, and large clots are frequently expelled.

Lacerations of the birth canal are rarely responsible for severe bleeding, except following artificial dilatation of the cervix. In this event, the blood is usually bright red in color and flows in a steady stream, which appears as soon as the child is delivered, and its loss continues even after the placenta has been expelled and the uterus has become firmly contracted.

Hemorrhage occurring after the completion of the third stage is most frequently due to imperfect contraction or atony of the uterine muscle, with consequent deficient constriction of the vessels at the placental site. In such circumstances, the uterus is soft and boggy when palpated through the abdominal wall, and pressure upon it leads to the extrusion of large quantities of clotted and fluid blood. The reaction to massage is weak or absent, and the bleeding continues until firm and persistent contractions have been induced. Atonic hemorrhage is more frequent after long, exhausting labors, and may follow excessive distention of the uterus by hydramnios or multiple pregnancy. In other cases, the retention of pieces of placenta, the presence of uterine myomata, or the existence of pelvic adhesions, may be the responsible factor.

Retention of a cotyledon torn from the body of the placenta, or of a succenturiate lobe, occasionally produces profuse hemorrhage after the main portion of the organ has been expressed. In this event, normal contraction and retraction are interfered with, precisely as in partial separation of the placenta, and the bleeding continues until the cause of the disturbance is removed.

Diagnosis.—As the bleeding in post-partum hemorrhage is almost invariably external in character, the diagnosis is therefore simple; although, if the uterus has not been carefully watched after delivery, large quantities of blood may collect within its cavity, and a condition of shock may supervene without the appearance of an unusual amount of vaginal bleeding.

The cause of the hemorrhage must be determined before satisfactory treatment can be instituted. If the bleeding begins at the end of the second stage, it is probably due to lacerations or to partial separation of the placenta. In the latter instance, it ceases as soon as the uterus is emptied, whereas, in the former, it continues. Atony is the most probable cause whenever the hemorrhage appears only after the placenta has been expelled and the uterus is soft and boggy. Examination of the afterbirth will ordinarily permit the detection of any missing portions, so that, if it is not complete, it is reasonable to assume that the retained tissue is responsible for the bleeding.

Treatment.—*Prophylactic.*—Most cases of post-partum hemorrhage due to partial separation of the placenta or to lacerations of the birth canal can be avoided by the adoption of certain prophylactic measures. To prevent the former, correct management of the third stage is of the greatest importance—the uterus should not be massaged during the process of separation, except as may be necessary to insure firm contraction, and expression should not be attempted until the rising of the fundus indicates that the placenta has passed into the lower segment. Meddling attempts to hasten the placental stage likewise predispose to retention of portions of the placenta, an accident which is otherwise rare. Furthermore, since lacerations of the birth passages usually follow artificial dilatation of the cervix, that procedure should be employed only when strictly indicated.

Atony of the uterus, on the other hand, occasionally cannot be avoided, since its cause may be beyond human control, but its more serious consequences can be obviated by always having available for instant use the materials needed for its effective treatment. The known tendency for the condition to follow unusual distention of the uterus by twins or hydramnios should lead to exceptional care in watching the uterus after such deliveries.

Curative.—The treatment of profuse bleeding will vary according as the placenta is still within the uterine cavity or has already been expelled, and, to be effective, depends upon the recognition of the particular factor responsible for its occurrence.

Hemorrhage during the third stage is usually due to partial separation of the placenta, and should be treated by kneading the uterus firmly through the abdominal wall in an attempt to induce strong contractions. If this is effected, the bleeding will cease or at least become more moderate, and complete separation will soon occur. But, if the hemorrhage persists, and the uterus becomes soft and flabby as soon as the manipulations are stopped, the placenta should be expressed by Credé's method. Repeated attempts to effect separation by this maneuver should be made before failure is admitted, since the remaining alternative is manual removal, which is attended by considerable risk of infection. In some instances, the administration of sufficient anesthetic to abolish the reflex contractions of the abdominal muscles will make easy what otherwise seemed impossible. As a last resort, after the failure of the Credé maneuver, and then, only in the presence of serious bleeding, or, in other cases, after a wait of at least an hour, the carefully sterilized hand is passed into the uterus and cautiously peels away the placenta. This is followed by a hot intra-uterine douche, in order to remove any tissue fragments, as well as to wash out any contaminating material, which may have been accidentally introduced. Traction should never be made upon the cord in these cases, since it is both inefficient and dangerous.

If the hemorrhage does not cease with the expulsion of the placenta, it must be due to atony of the uterus, to lacerations of the birth canal or to retention of a cotyledon. Since the first factor is usually responsible, the uterus should be vigorously massaged, in order to keep it in a state of constant contraction. The success of this maneuver practically eliminates the other possibilities, so that all that remains is to continue the massage and to supplement it by the administration of ergot and pituitary extract.

On the other hand, if the uterus cannot be kept firmly contracted, or, if the bleeding persists in spite of it, other measures must be adopted. In the first place, the cervix is exposed with speculum and tenaculum, so that any lacerations may be recognized and sutured. Meanwhile, ergot and pituitary extract are injected intramuscularly and a douche of hot sterile water is prepared—temperature 115° to 120° F. (46° to 49° C.), and injected into the uterine cavity without delay, if the hemorrhage continues. The action of the heat, combined with the irritation of the douche nozzle, generally produces strong uterine contractions, but, in the rare instances in which it is not effectual, the uterine cavity should be tightly packed with sterile gauze, which should be removed after twelve hours, or less, as longer retention increases the possibility of infection. Except in the very exceptional case, in which the atony is due to actual disease of the uterine muscle, this procedure is uniformly successful.

As soon as the hemorrhage has been checked, attention must be given to the patient's general condition, and, if signs of shock have developed, treatment along the lines already laid down should be immediately begun.

To summarize the etiology and treatment of post-partum hemorrhage:

Bleeding before the placenta is expelled is due to:

1. Partial separation of the placenta, which is treated by massage, the Credé maneuver, or by manual removal.
2. Lacerations of the birth canal, which are repaired by sutures.

Bleeding after the placenta has been expelled is due to:

1. Atony of the uterus, treated by massage, ergot, pituitary extract, hot intra-uterine douche, or the uterine pack.
2. Lacerations of the genital tract, treated as above.
3. Retention of portions of the placenta, which must be removed.

Puerperal Hemorrhage.—The danger of post-partum hemorrhage may be considered as passed after the first hour or two following delivery, but occasionally severe bleeding may occur later in the puerperium—*puerperal hemorrhage*. This complication usually makes its appearance toward the end of the first week or ten days, and is commonly due to the retention of small portions of placenta, which were overlooked at the time of delivery and did not give rise to immediate symptoms. They seriously interfere with the involution of the uterus, and, unless they undergo spontaneous necrosis and are cast off in the lochia, may lead to profuse and protracted bleeding, which not infrequently is accompanied by an irregular fever, due to the invasion of micro-organisms.

The usual treatment for sub-involution of the puerperal uterus may diminish the amount of bleeding, but it will not cease permanently until the retained tissue has been removed. The patient's history will usually suggest the diagnosis, but it can only be made absolute by the introduction of the finger into the uterus and the palpation of the adherent mass. After its removal by digital curettage, involution proceeds normally.

The Nurse's Responsibility in Hemorrhage Cases.—The greater part of the responsibility in the care of hemorrhage cases must be borne by the physician, but certain details are generally considered a part of the nurse's duties.

In the presence of *acute ante-partum hemorrhage*—to be carefully differentiated from the "show," which merely signalizes the onset of labor—the physician should be notified at once, and the urgent need for his presence should be insisted upon. Meanwhile, the patient should be put to bed and kept absolutely quiet. *No vaginal examinations should be made and no drugs given,* but an ice cap may be placed over the abdomen. An abundant supply of hot water should be at hand, and preparations for a carefully conducted examination should be made in anticipation of the doctor's arrival.

In such an emergency, the nurse cannot carry out any of the measures, which have been indicated, without tremendously increasing the danger to the patient. She should remember that the first hemorrhage is very rarely fatal and that ill-advised attempts at treatment may do more harm than good.

Post-partum hemorrhage, occurring during or immediately following the third stage, usually finds the doctor at hand to direct the measures for its relief, but if the nurse is alone when the emergency arises, her duty is to massage the uterus through the abdominal wall to insure firm contractions, in the hope that, if the placenta has not been extruded, its separation may be made complete. *Do not give ergot or pituitary extract before the placenta is expelled. Do not pull on the cord or examine vaginally.*

On the other hand, if the bleeding continues after the end of the third stage, the uterine massage should be continued, and pituitary extract (1 cubic centimeter) or ergotole (40 minims) given at once by deep hypodermic injection. In the majority of cases of atony, these two procedures lead to firm contraction of the uterus and to cessation of the bleeding, and the nurse is not justified in attempting to give an intra-uterine douche or to pack the uterus. *Continue the massage until the bleeding ceases.*

The prevention of bleeding by watching the condition of the uterus is the prime duty of the nurse during the first hour after delivery, and nothing should be allowed to interfere with it. She should palpate the uterus at frequent intervals, and, at the first sign of its softening, vigorous massage should be begun and continued until it again becomes firm. It is not sufficient to rub the abdominal wall, as is so frequently done, but the flabby uterus should be seized between the fingers and vigorously kneaded, until it contracts down into a hard round mass occupying the mid-line of the lower abdomen. The importance of this duty cannot be insisted upon too strongly, as the death of not a few women is directly attributable to its neglect. The natural tendency of the nurse is to interest herself in the baby, but it should always be remembered that her first duty is to the mother, who should be most conscientiously watched, until all danger of hemorrhage has passed.

Recuperation after Hemorrhage.—Ordinarily, the patient, who has had even a severe hemorrhage, enjoys a normal puerperium, except for the weakness attending the acute anemia. Fresh air and good food are necessary for the rapid regeneration of the blood. Certain articles of diet, such as milk, spinach and carrots, are particularly valuable because of their high iron content. Arsenic in the form of Fowler's solution (minims III, t. i. d., a. c. increasing gradually to minims X, t. i. d., a. c.), or iron, as Blaud's pills (grains V, t. i. d., p. c.) may be useful during the convalescent period, while, in the most urgent cases, prompt blood transfusion gives almost miraculous results.

CHAPTER XVI

ABNORMAL LABOR

It has previously been stated that the chief factors concerned in labor are: (1) the force of the uterine and abdominal muscular contractions, (2) the configuration of the pelvic cavity, and the pelvic floor, and, (3) the size and shape of the fetus. It is obvious that abnormalities in any one or more of these may complicate the birth process, and, moreover, that various accidental happenings may render labor abnormal.

The term *dystocia* is applied to all cases of difficult labor from whatever cause, as contrasted with *eutocia,* which is sometimes used to designate a normal spontaneous delivery. Labor is arbitrarily designated as *prolonged,* whenever the process is not completed within twenty-four hours; but prolonged labor is not necessarily synonymous with dystocia, since many extremely difficult labors terminate within a much shorter period.

ANOMALIES OF THE EXPULSIVE FORCES

Normally, labor begins with pains, which are of short duration and recur at intervals of ten or more minutes, but which become more severe and frequent as parturition proceeds until finally the child is expelled without assistance. During the first stage, the uterine muscles alone are concerned, whereas in the second stage the abdominal muscles render very material assistance.

Uterine Inertia.—Insufficiency in the force of the uterine contractions is commonly designated as inertia, and may complicate any part of labor, but is more frequently observed during the first stage. The inertia may be *primary,* in that the pains are weak and ineffectual from the onset, or *secondary,* when pains, which were of good quality for a time, sooner or later lose their effectiveness, so that the birth process progresses very slowly or comes to a standstill. The condition is generally attributed to a faulty condition of the uterine muscle and is usually observed in poorly developed women, in large obese individuals, or in those who have had a number of pregnancies in rapid succession.

In the absence of any mechanical obstruction, prolongation of labor from inertia may be viewed with equanimity, so long as it is not associated with a rise of temperature or pulse, which indicate exhaustion of the mother or intra-partum infection, or with serious alterations in the fetal heart rate, which mean that the child is in danger from asphyxiation. In most instances, the inertia is only temporary and the ineffectual contractions will sooner or later be replaced by those of normal intensity, but, if no improvement occurs within a few hours, steps should be taken to stimulate the activity of the uterus.

In the first stage, this is sometimes very difficult, and no single procedure can be relied upon. Among the simpler remedies, the administration of castor oil, one ounce (thirty cubic centimeters), with quinin, ten grains (0.6 gram) is frequently quite effective. Within the last few years, the hypodermic injection of the hydrochlorid of quinine in $7^1/_2$ grains (0.5 gram) doses has been proposed, but it gives little better results than the older method. Occasionally, if rest and sleep can be induced by its use, morphin $^1/_4$ grain (15 milligrams) is useful, as the pains will improve very considerably as soon as the patient awakes. Again, if the cervix is more than half dilated when the pains cease, artificial rupture of the membranes may cause them to assume their natural intensity and lead to a rapid delivery. In more obstinate cases, however, it may be necessary to employ mechanical stimulation, and, for this purpose, the introduction of a rubber bag is very effective, but because of the danger incident to the increased vaginal manipulation, it cannot be recommended in every case. Pituitary extract has no place in the treatment of uterine insufficiency at this time and may result in irreparable injury.

In the absence of disproportion and abnormal presentations, delay occurring during the second stage may be attributable to poor uterine contractions or to defective bearing down with the abdominal muscles. The former is ordinarily a part of a pre-existing inertia, while the latter may be due to fear that voluntary straining will increase the pain, or to actual physical disability of the muscle resulting from previous excessive distention or from disease.

If the fault seems to be with the uterus, pituitary extract is frequently very effective in stimulating stronger contractions and thus hastening delivery. It should, however, be used cautiously, since it is impossible to foretell how strenuously it will act. Furthermore, it should be given only after the cervix is fully dilated and then, only when there is no mechanical obstacle to delivery. The required dose, 3 to 15 minims (0.2 to 1.0 cubic centimeter) is given hypodermatically into the deep tissues of the shoulder or buttocks and the point of injection is gently massaged to promote absorption. In favorable cases, the pains become more frequent and severe within three minutes and delivery is soon effected; but, at times, the action is so tumultuous that the uterus becomes tetanically contracted, when it not only does not assist the birth process, but is associated with asphyxiation of the child, and occasionally with rupture of the uterus. In such circumstances, rapid delivery by the simplest procedure is urgently indicated, and for this reason it is wise to make the necessary pre-operative preparations before administering the drug. Many physicians prefer not to employ the pituitary extracts and consequently proceed to instrumental delivery when confronted with lack of advance during the second stage.

When the delay is occasioned largely by the absence of abdominal efforts, treatment will depend upon the cause of the condition. If the muscles have been weakened by previous pregnancies, or are so widely separated that they cannot be effectively used, mechanical assistance will usually be necessary, whereas, if the patient merely refuses to assist because of the fear of added pain, the administration of light obstetrical anesthesia ordinarily results in effective co-operation.

The preceeding paragraphs naturally lead to a consideration of the indications for operative interference on the basis of delay during labor. A prolonged first stage is not generally considered a justifiable indication for intervention, so long as the condition of the mother and child remain satisfactory. In the event that the mother's condition becomes unsatisfactory, however, the usual procedure is to complete the dilatation of the cervix manually or by means of a rubber balloon, and to deliver by forceps or version as seems most practicable. On the other hand, there is always a certain amount of danger to the child associated with a prolonged second stage, so that somewhat arbitrary time indications for interference have been generally adopted. The usual rule is that a delay of two hours in mid-pelvis, or of one hour on the perineum, without advance, indicates that the probability of spontaneous delivery is slight, and that artificial delivery is demanded.

Third stage inertia, or atony of the uterus, has been discussed in the section on post-partum hemorrhage.

Prolonged Pregnancy.—Although labor ordinarily sets in about two hundred and eighty days after the beginning of the last menstrual period, an occasional patient may go considerably beyond the expected date of confinement, when the fetus grows to an unusual size. Apparently, in such cases, the normal stimulus which brings on labor is absent or at least insufficient, so that the uterine muscle does not begin its expulsive contractions at the usual time. As such a prolongation may lead to serious disproportion between the size of the child and the pelvis, it should be the rule, whenever the history suggests the possibility of an over-term pregnancy and the child is above average size, to induce labor artificially. As such patients are not especially prone to uterine inertia at the time of labor, it would seem that the condition of the uterine muscle can scarcely be responsible for the delay.

Missed Labor.—Very rarely labor sets in at the calculated date, and, after continuing for a time, ceases without the child having been delivered. The latter soon dies and then may be carried for months, gradually becoming smaller as the result of mummification. Treatment consists in inducing labor as soon as the diagnosis is made.

Tetanic Contraction of the Uterus.—Occasionally in the course of obstructed labor, the uterus passes into a condition of tetanic contraction with no alternating periods of relaxation. In such circumstances, the birth of the child is out of the question, and, if the condition persists, there is great danger that the uterus may rupture with the escape of the child into the peritoneal cavity. A general anesthetic will frequently relieve the condition sufficiently to permit instrumental delivery.

Hour-Glass Contraction.—More rarely still, the section of the uterus at the lowermost portion of the upper segment—Bandl's ring—undergoes isolated tetanic contraction, while the portions above and below it remain soft and flaccid. This results in an hour-glass contraction, which always offers a serious obstacle to delivery and may necessitate an abdominal operation.

Precipitate Labor.—Very rapid delivery occasionally occurs, particularly in multiparae, but, occasionally, even in primiparous, women. As it is frequently associated with painless dilatation of the cervix, the whole labor may apparently consist of only a few expulsive pains. For this reason, the child may be born before the arrival of the doctor, with the result that deep perineal lacerations may occur.

Dystocia Due to Abnormalities of the Birth Canal.—In this category are grouped those cases of dystocia, which are due to mechanical obstacles resulting from abnormal conditions obtaining in the birth canal. Only the most frequently observed conditions will be discussed.

SOFT PART DYSTOCIA

Rigidity of the Perineum.—Although in most instances of so-called "rigid perineum" the delay in delivery is actually due to deficient force of the pains, as is evidenced by the satisfactory progress made after an effective dose of pituitary extract; yet in certain elderly primiparae, as well as in women who have been subjected to a secondary perineorrhaphy, the slow advance may be attributed to the unusual firmness and lack of elasticity of the perineal structures. In this event, delivery may be delayed in spite of strong second stage pains, and, eventually, the tissues tear before becoming dilated. In such circumstances, forceps are frequently indicated, and at times episiotomy may be necessary to facilitate extraction.

Rigidity of the Cervix.—Occasionally, in elderly primiparae, the cervix is exceptionally rigid and dilates slowly under the influence of strong pains. Still more rarely, a similar condition may result from an old inflammatory process with infiltration and scarring of the tissues. Such dystocia is rarely very marked, and patience will usually be rewarded to the extent that operative interference, should it finally become necessary, will be relatively simple. Sometimes a Voorhees bag is employed to hasten the period of dilatation. In spite of the fact that the probability of serious trouble is not great, cesarean section is frequently advised in patients approaching the menopause, for the purpose of insuring the birth of a living child, which may be particularly important in view of the uncertainty as to whether another pregnancy will ever occur. The same operation followed by a radical total hysterectomy is the procedure of choice, in the rare instances in which the rigidity is due to carcinoma of the cervix.

Atresia of the Cervix.—Pregnancy is impossible in patients in whom the cervix is completely occluded; but, in rare instances, after conception has occurred, its canal becomes obliterated by scar tissue resulting from inflammatory changes. In this event, the pregnancy may go on and labor may set in at the proper time. As examination reveals the absence of any cervical opening, abdominal delivery constitutes the only procedure by which the child can be extracted. In most such cases, the uterus is removed at the same time, since the cervical condition is not susceptible of correction by operation or medicinal treatment.

Displacements of the Cervix.—Cervical displacements due to abnormal positions of the uterus, naturally acquired, or resulting from operative procedures designed to correct existing uterine displacements, may sometimes lead to most extreme dystocia. In such cases, the cervix no longer points directly downward in the pelvic axis, as normally, but becomes directed toward the sacrum or the symphysis, so that the presenting part of the child cannot impinge upon it. Consequently, the force of the uterine contractions cannot be utilized to effect its dilatation, but are expended against some other portion of the uterine wall. If the displacement is extreme, vaginal delivery is usually out of the question, so that cesarean section is the operation of choice.

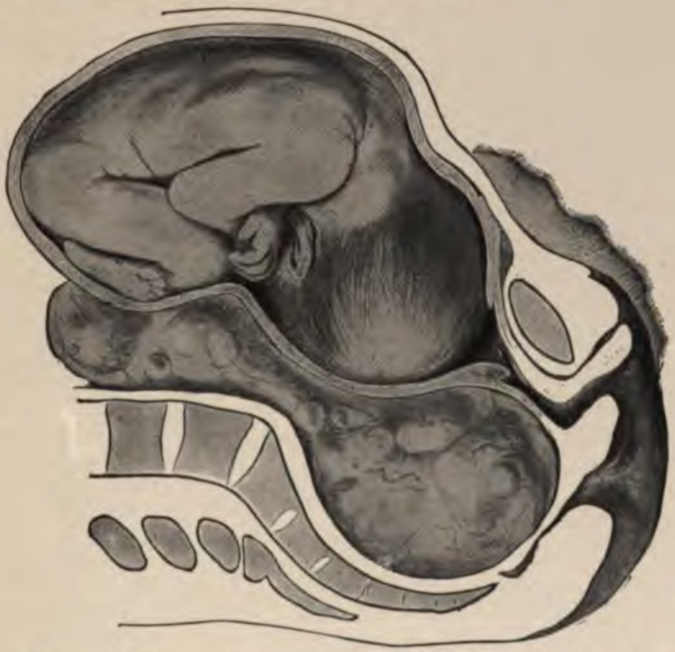


FIG. 118.—Dystocia due to ovarian cyst blocking the pelvis. (Williams after Bumm.)

Pelvic Tumors.—Very rarely, an ovarian cyst or a uterine fibroid may occupy the pelvic cavity and so obstruct its canal that descent of the child is impossible. Such a condition can be easily recognized during vaginal examination, and can be successfully treated only by abdominal delivery followed by removal of the tumor.

DYSTOCIA DUE TO CONTRACTED PELVIS

A pelvis is designated as contracted, whenever any one of its diameters is so shortened as to affect materially the normal mechanism of labor, but without necessarily retarding delivery. In most cases of slight contraction, this interference may be manifested only by the fact that the presenting part engages later than it otherwise would. Thus, in a normal primipara, the head usually descends into the pelvis several weeks before the end of pregnancy, whereas, in this event, engagement will not occur until after the onset of labor, and yet the duration and apparent difficulty of labor will not be increased. On the other hand, the degree of contraction may be so great that spontaneous delivery of a full-term child is impossible.

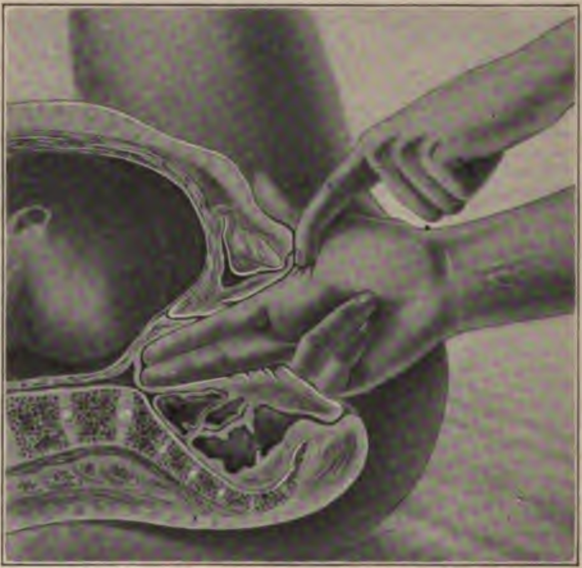


FIG. 119.—Measuring the diagonal conjugate. (Williams.)

The Diagnosis of Contracted Pelvis.—The usual external pelvic measurements give only approximate information concerning the existence of contractions of the pelvic inlet, but they are, nevertheless, of considerable value in that their shortening frequently suggests such a possibility; while their relation to one another affords a basis for their classification. On the other hand, the determination of the diagonal conjugate, the one internal diameter, which can be readily measured, gives definite information concerning the antero-posterior diameter of the superior strait. This measurement, then, enables us to recognize the existence of inlet contraction, and it is customary to designate as contracted all pelves in which it is 11.5 centimeters or less, when all the external measurements are somewhat shortened, or 11.0 centimeters or less, when they are normal. In such cases, provided the child is of average size, there will be some disturbance of the birth mechanism.

Outlet contractions are determined by measurement of the distance between the ischial tuberosities, and when it is 8.0 centimeters or less, the pelvis is said to be funnel-shaped.

Types of Contracted Pelves.—The three most common types of pelvic contraction are the generally contracted, the flat and the funnel-shaped.

Generally contracted pelves are divided into two groups—typical and rachitic. In both, all measurements are below normal, and the diagonal conjugate measures 11.5 centimeters or less. The former is more commonly observed in under-sized women, and is the most frequent type of pelvic contraction, whereas the latter occurs only in those who have suffered from rickets during infancy, and is associated with characteristic changes in the bones of the pelvis and the skeleton generally.

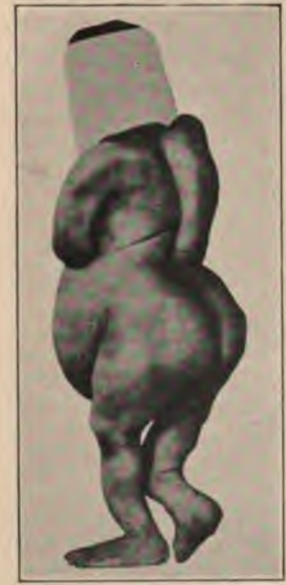


FIG. 120.—Rachitic dwarf showing pronounced deformity.

Flat pelves may likewise be associated with rickets, so that both simple flat and flat rachitic pelves are seen. In general, flat pelves have approximately normal transverse diameters, but are shortened in the antero-posterior diameter, the diagnoal conjugate measuring 11.0 centimeters or less. Simple flat pelves occur most frequently in white women, in whom they represent about one-sixth of all pelvic contractions, and frequently give rise to serious pelvic dystocia. The flat rachitic type is, as the name implies, associated with general rickets, and, consequently, is more commonly observed among colored women.

Funnel-shaped pelves usually occur in women whose pelvic measurements are otherwise normal, but they may occur in association with any other type of contraction. In funnel pelves, the pubic arch has lost its normal feminine width and approaches the male type, with closely approximated ischial bones, so that they are sometimes designated as *masculine pelves*. They represent the type most frequently observed in white women, but only rarely is the contraction sufficiently pronounced to give rise to serious dystocia.

To summarize briefly, the following chart gives at a glance the essential features of the varieties of contracted pelves most frequently encountered.

Chart Showing Measurements in Different Types of Contracted Pelves

	Inter-spinous cm.	Inter-cristal cm.	Bi-troch-anteric cm.	Ext. Conj. cm.	Diag. Conj. cm.	Tubera Ischii cm.
Normal pelvis	26	28	31	21	12.75	11.0
Generally contracted—typical	less than 26	less than 28	less than 31	18 or less	11.5 or less	less than 11.0
Generally contracted—rachitic	less than 26	less than 28	less than 31	18 or less	11.5 or less	less than 11.0
Simple flat	26	28	31	18 or less	11.0 or less	11.0
Flat rachitic	26	28	31	18 or less	11.0 or less	11.0
Funnel-shaped	26	28	31	21	12.75	8.0 or less

Other types of contracted pelves occasionally occur as the result of unusual conditions, but they are observed too rarely to be discussed here. For example, unilateral lameness, bilateral dislocation of the hips, lumbar kyphosis and fracture of the pelvic bones may produce pelvic abnormalities which may entail serious obstetrical consequences.

The Effect of Contracted Pelvis upon Pregnancy.—The inability of the presenting part to sink into the pelvis during the last weeks of pregnancy has a tendency to increase the abdominal distention. Especially in primiparae, the fundus may rise so high as to cause considerable interference with respiration. In other cases, a lax anterior abdominal wall may yield to the pressure of the uterus and give rise to a typical "pendulous abdomen," which is of little significance in multiparous women, because of the lack of muscle tone resulting from previous pregnancies, but which always indicates considerable disproportion in primiparae.

The presence of disproportion between the head of the fetus and the pelvis likewise tends to the production of abnormal positions, so that there is a decided increase in the incidence of face, breech and transverse presentations, while vertex presentations become less common. The frequency of such abnormalities increases with the degree of contraction, particularly in multiparous women, in whom the flabby abdominal wall acts as a predisposing factor. Indeed, it may be said that, in primiparae, face and transverse presentations rarely occur except as a result of distinct disproportion.

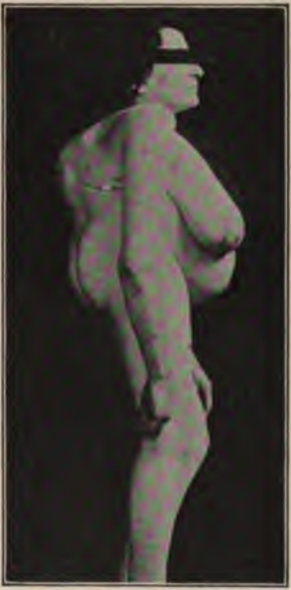


Fig. 121.—Patient with marked kyphosis—nine months pregnant. Pelvis normal. Spontaneous labor at term.

Generally speaking, there is little relation between the size of the fetus and the dimensions of the pelvis, except that small individuals, in whom generally contracted pelves are usually encountered, have a tendency to bear children smaller than the average.

Labor in Contracted Pelves.—The possibility of a spontaneous outcome in such cases depends upon three factors: (1) the actual size of the pelvis, (2) the size and compressibility of the fetal head, and (3) the effectiveness of the expulsive forces.

The Size of the Pelvis.—Spontaneous delivery occurs less frequently as the size of the pelvis diminishes, so that when the diagonal conjugate is reduced to 9.5 to 10.0 centimeters (true conjugate of 8.0 to 8.5 centimeters) its chances are reduced by one-half, and, when it falls to 9.0 centimeters (true conjugate of 7.5 centimeters), less than one-fifth of the children are born spontaneously. Moreover, when it measures below 7.0 centimeters (true conjugate of 5.5 centimeters) vaginal delivery is impossible even after craniotomy; whereas, between this limit and 9.0 centimeters, the delivery of a dead child can be effected with difficulty, while the extraction of a live child through the vagina is not to be expected.

The size and compressibility of the fetal head are subject to considerable variations and cannot be easily determined before birth, although it is generally recognized that women in the upper walks of life are more likely to have large, hard-headed babies than those who apply to the charity clinics. In any given case, the course of labor depends not so much upon the absolute, as upon the relative, size of the head, which can be determined with considerable accuracy by pressing the head down into the superior strait and estimating, by palpation, the extent to which it projects beyond, or "over-rides," the symphysis. In white women living under good surroundings, the existence of even moderate disproportion probably means that the dystocia will be of a serious nature, whereas, in colored patients, the same amount of over-riding may generally be viewed without alarm, because, in the latter, the fetal head will almost certainly be smaller and less perfectly ossified, so that, under the influence of strong pains, it can be compressed sufficiently to permit its passage through the superior strait.

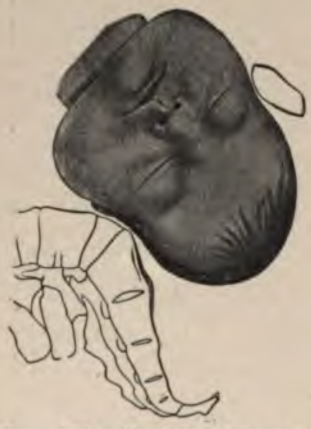


FIG. 122.—Showing disproportion between the head and the pelvis. (Williams.)

The effectiveness of the expulsive forces cannot be prognosticated in advance, but is generally not at fault in primiparous patients; whereas, in multiparae with abdominal and uterine musculature impaired by the strain of previous gestations, secondary uterine inertia may lead to a first stage dystocia, or may prevent the spontaneous completion of the second stage, even though the disproportion is not extreme.

The Course of Labor in Contracted Pelves.—Labor is usually prolonged either by reason of imperfect dilatation of the cervix, or because of the length of time required to mold the head so that it may descend through the pelvis. Moreover, the occurrence of an unusually large percentage of abnormal presentations tends to more difficult labors.

When the head presents, it finds difficulty in engaging in an oblique diameter of the pelvic inlet, and frequently descends with the sagittal suture directly transverse—R. O. T. or L. O. T.—a condition which rarely occurs in normal pelves. In such circumstances, the head fits only loosely into the superior strait, and, as a result, premature rupture of the membranes and prolapse of the cord are rather frequent complications. The former results in delay in the dilatation of the cervix, in that it must now be accomplished by direct pressure of the head, which is impossible until descent has taken place or until a marked caput succedaneum has been formed. Prolapse of the cord, on the other hand, is a very serious accident for the child, since it may be compressed between the head and the pelvic wall, with the result that its circulation will be cut off and lead to asphyxiation of the child.

When the disproportion is marked and the head is arrested at the superior strait, a prolonged but ineffectual second stage frequently leads to tetanic contraction of the uterus and to extreme thinning of the lower uterine segment, with its danger of uterine rupture. In this event, operative delivery is essential if the latter possibility is to be avoided.

The unusual length of the labor in patients with contracted pelves predisposes to greater danger from intra-partum infection and to actual physical exhaustion, both of which afford an indication for interference. Moreover, the child is apt to be seriously affected by the prolonged pressure, especially if the membranes have ruptured prematurely. Changes in the rate of the fetal heart beat indicate the imminence of such danger and afford an urgent indication for intervention.

Prognosis.—Since the chance of an easy labor decreases rapidly as the size of the pelvis is diminished, the prognosis for mother and child will depend upon the degree of contraction, as well as upon the method chosen for delivery. Thus, the performance of cesarean section at an appointed time, whenever the degree of disproportion is serious, has practically eliminated the extremely difficult vaginal deliveries, which were formerly employed, thereby diminishing the former high death rate, and reducing the mortality to that which is inherent in the operative procedure—one to two per cent for the mother and practically nothing for the child.

Treatment.—The treatment of contracted pelves depends not so much upon the actual measurements, as upon the existence of disproportion between the size of the child and the pelvis. In the most extreme grades of contraction, with a diagonal conjugate of 7.0 centimeters or less, abdominal delivery is absolutely required, if the child is at term, irrespective of whether it is alive or dead, because in such conditions craniotomy is a much more dangerous procedure. This constitutes the *absolute indication* for cesarean section, whereas, in the next group of pelves with a diagonal conjugate of 7.0 to 9.0 centimeters, cesarean section will be necessary if the child is alive, but, if dead, delivery can be effected by destructive procedures. Finally, when the diagonal conjugate varies between 9.0 and 11.5 centimeters, the method of delivery will depend upon the degree of disproportion. With the modern development of cesarean section into a very safe procedure, when performed under ideal conditions, the treatment of these so-called "border-line" cases really resolves itself into a question of obstetrical judgment in each individual case. If the disproportion is moderate, the chances are that spontaneous delivery will occur, and such an outcome is always preferable to abdominal cesarean section; whereas, if the disproportion is such that a spontaneous outcome appears unlikely, cesarean section should be done before the onset of labor. At present, the tendency is more and more toward "playing safe," so that in most institutions the presence of a questionable amount of disproportion is regarded as sufficient indication for cesarean section. It should, however, be remembered that such a decision implies that Nature is bankrupt, and in many instances the skill of the obstetrician should be gauged not by the number of cesarean sections he has performed, but rather by the number of "border-line" cases, which he has led to a spontaneous and happy conclusion. Under present conditions, any tyro can perform a section, but it often requires a high degree of obstetrical skill and judgment to decide that it is necessary.

DYSTOCIA DUE TO ABNORMALITIES IN DEVELOPMENT OR PRESENTATION OF THE FETUS

Excessive Size, Hydrocephalus, Enlargement.—Such abnormalities in the development of the fetus as excessive size, hydrocephalus and localized enlargement of its body, which may give rise to dystocia, have already been discussed in the chapter on The Diseases and Abnormalities of the Ovum and Fetus.

Abnormal Presentations.—Normally, as has already been stated, the head of the fetus presents at the superior strait and descends through the pelvis in advance of the remainder of the body. Whenever another portion of the child presents, the usual mechanism of labor is interfered with, and, in some instances, dystocia may result solely by reason of the abnormal presentation.

Transverse Presentations.—In this abnormality, the long axis of the child lies at right angles to that of the mother, so that the shoulder becomes the presenting part. Although such a presentation in a primipara is almost invariably associated with disproportion between the size of the child and the pelvis, it has no such significance in multiparae, since in the latter its occurrence is favored by the laxity of the uterine and abdominal walls. Spontaneous labor is generally impossible, although it may occur under very rare circumstances as the result of a peculiar sequence of events, known as *spontaneous evolution,* whereby the fetus can be forced through the pelvis under the influence of strong pains. This, however, occurs so rarely that it can never be counted upon, so that for all practical purposes transverse presentations invariably demand interference.

The diagnosis is made by abdominal palpation, by vaginal touch, or by inspection, when a hand and arm project from the vagina. The accepted method of treatment is by version; whenever possible, an external version is done late in pregnancy or early in labor, and then delivery occurs by the vertex or breech, as the case may be. When, however, this cannot be accomplished, which is usually the case, labor is allowed to proceed until the cervix is fully dilated, when the child is turned by internal podalic version and promptly extracted. In neglected cases, the shoulder has become impacted in the pelvis, and the uterus is so tightly contracted over the child, as to make version impossible. In these circumstances, the treatment varies according as the child is dead or alive. If it is dead, decapitation is performed with Braun's blunt hook and followed by extraction of the body by traction upon the

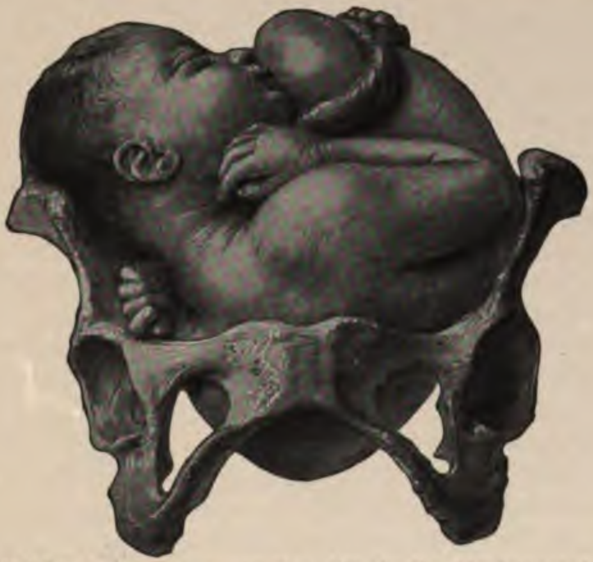


FIG. 123.—Child in transverse presentation with the shoulder impacted in the pelvic brim. (Williams.)

arm and delivery of the head by means of forceps. On the other hand, if the child is in good condition and the patient a multipara with other living children, cesarean section is the operation of choice, and is usually followed by removal of the uterus in order to avoid the dangers of serious infection, which so frequently develops when abdominal delivery is done late in labor. If, however, the patient is a primipara, such radical treatment is questionable, as it permanently destroys the reproductive function, and so does away with the possibility of future pregnancy. Under these circumstances, it may be advisable to perform decapitation and extraction on the living child, in order to preserve to the patient the chance of further child-bearing.

Compound Presentations.—This term refers to the prolapse of an arm or hand alongside the presenting part, so that the prolapsed extremity interferes with the engagement and descent of the head. Under such conditions, spontaneous delivery usually occurs, but, if serious dystocia develops, time should not be wasted in attempts to replace the prolapsed part, but labor should be terminated by version.

Breech Presentations.—Breech presentations in themselves rarely cause any serious dystocia, but because of the inherent danger to the child from pressure of the aftercoming head upon the umbilical cord, breech extraction is generally employed whenever the normal progress of labor is interfered with. When, occasionally, through the inability to compare accurately the relative size of the head and the pelvis, a serious disproportion is found to exist, only after the child has been partially extracted and the head is arrested by the contracted pelvic inlet, recourse may be had to perforation of the after-coming head, in order to reduce its diameters and permit its delivery.

Face presentations usually end spontaneously, but when such an outcome is too long delayed, forceps are applied, if the presenting head is well down in the pelvis, or version and extraction, if it has been arrested at the pelvic brim.

LACERATIONS OF THE BIRTH CANAL

Perineal Lacerations.—These have already been considered in Chapter VIII.

Cervical Lacerations.—Slight lacerations of the cervix are so inevitably a result of labor that their recognition is generally accepted as evidence of previous childbearing. More severe tears rarely occur during spontaneous labor, but are frequent as a result of manual dilatation of the cervix and ill-advised attempts to effect delivery through the partially dilated external os. Under such circumstances, the tear usually extends laterally on one or both sides. Ordinarily, in the course of a delivery effected after complete dilatation, the possibility of cervical tears is not considered, unless post-partum hemorrhage occurs, which is obviously not the result of uterine atony nor of the retention of placental fragments. The diagnosis is established by drawing the cervix down to the vulva with tenaculum forceps and inspecting it directly, when the location and extent of the tear is determined.

Whenever the laceration is particularly deep or is actually causing hemorrhage, it should be immediately repaired with interrupted catgut sutures. Small lesions need not be repaired unless they bleed, since they usually heal spontaneously.

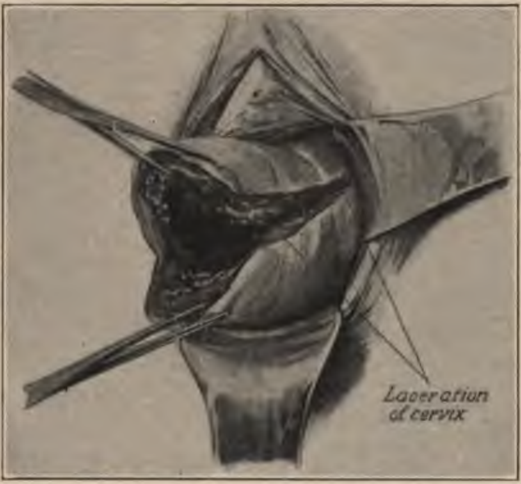


FIG. 124.—Laceration of the cervix. (Bumm.)

Rupture of the Uterus.—Rupture of the pregnant uterus, which may be either spontaneous or traumatic in origin, is one of the most serious obstetrical accidents. Spontaneous rupture occasionally occurs during the course of pregnancy and is commonly due to excessive invasion of the uterine wall by fetal elements or to the rupture of weakened scars resulting from previous operations, more particularly cesarean section. At the time of labor, it is usually due to overstretching of the lower uterine segment, which has developed in the course of a prolonged, obstructed labor. The accident may occur in head or breech presentations, if there is serious disproportion, but is more common in neglected transverse presentations. Traumatic rupture may be produced during intra-uterine manipulations on the part of the physician in a tightly contracted uterus with a thinned out lower segment, or it may result from the upward extension of deep cervical lacerations.

The rupture may be *complete,* when the fetus and its membranes are extruded into the peritoneal cavity, or *incomplete,* when the product of conception escapes only partially from the uterine cavity. The former is the more frequent.

When occurring during pregnancy, the accident is generally accompanied by severe abdominal pain and shock, although in certain instances the latter may be almost entirely absent. The diagnosis is difficult and may not be made until after the abdomen has been opened at operation. The occurrence of rupture during a prolonged, difficult labor, however, produces more characteristic signs and symptoms, so that it is usually correctly diagnosed. At the height of a uterine contraction, the patient complains of a sudden sharp pain in the lower abdomen and may say that she feels as if something had broken inside. The uterine contractions now cease and the patient feels more comfortable than previously. There is usually some vaginal bleeding, and a marked change in the configuration of the abdomen. The fetus is more readily palpable than before and its heart sounds are no longer heard, the presenting part rises completely out of the pelvic cavity, and the tightly contracted uterus can be felt to one side of the fetus. Symptoms of collapse usually appear promptly, when the pulse becomes rapid, the skin and mucous membranes pale, the respirations accelerated, although the patient rarely loses consciousness until just before death.

The prognosis for the child is invariably bad, since it promptly becomes asphyxiated from the separation of the placenta. On the other hand, the outlook for the mother depends largely upon the prompt recognition of the trouble and the institution of surgical treatment. If the abdomen is opened within an hour after rupture, the mortality is relatively low, but if interference is delayed, the prognosis becomes progressively worse, so that practically all die who are not operated upon.

Treatment. — Prophylactic treatment in the form of intelligent supervision during pregnancy and labor greatly reduces the incidence of uterine rupture. This implies particularly the recognition and rational treatment of all cases of disproportion, and the prompt delivery of all transverse presentations by version as soon as the cervix is fully dilated.

When the rupture has actually taken place, laparotomy should be performed at once, so that the extent of the lacerations may be determined and necessary surgical treatment adopted. Without doubt, the best results follow removal of the uterus, even though, as in incomplete rupture, the tear may be small, as the majority of such patients were in all probability already infected before rupture occurred, so that simple suturing of the rent, as is sometimes advocated, does not remove the danger of puerperal peritonitis. In occasional cases of incomplete rupture, after the child has been delivered from below, the introduction of a tight uterine pack may result in complete cure, although such treatment is not to be recommended when facilities are available for surgical intervention.

PROLAPSE OF THE UMBILICAL CORD

Prolapse of the umbilical cord during the course of labor is one of the most serious accidents which can befall the child and is a frequent cause of still-birth. It is likely to occur whenever the presenting part does not fit tightly into the superior strait at the time the membranes rupture. Accordingly, it occurs more frequently with transverse and breech presentations, as well as with cephalic presentations associated with disproportion. For the latter reason, abnormally large children predispose to it, while the accident is also favored by hydramnios and lax abdominal or uterine walls. As most of these factors are more commonly encountered in multiparous women, it is natural that prolapse of the cord rarely occurs in primiparae.

The serious consequences of the accident are attributable to compression of the cord between the pelvis and the fetus, which cuts off the fetal circulation. In shoulder or breech presentations, where the presenting part is more irregular, the compression is apt to be less and the fetal asphyxiation more gradual than when the head presents. The condition is diagnosticated by the palpation of a loop of cord in the vagina or more rarely by its appearance at the vulva. Sudden cessation of the fetal heart sounds should always suggest its possibility.

Treatment.—The treatment varies with the degree of cervical dilatation obtaining when the accident is recognized, as well as with the presentation and condition of the fetus. With the cervix fully dilated or easily dilatable, prompt delivery offers the best chance for the child, which is good if the cord is pulsating strongly when the operation is begun. When the head or shoulder presents, podalic version is the operation of choice, whereas with breech presentations rapid extraction is indicated. Prolapse through a small cervix is much more serious, because immediate delivery can be effected only by such radical operations as manual dilatation of the cervix or vaginal or abdominal cesarean section, which subject the mother to greatly increased risks and are therefore rarely justified. Attempts to replace the cord by means of the hand, or by special repositors are rarely successful, while the assumption of the knee-chest posture is usually ineffectual. Occasionally, it may be possible to hold the cord up, while a Voorhees bag is inserted. The latter will effectually retain the cord in place, but its expulsion may

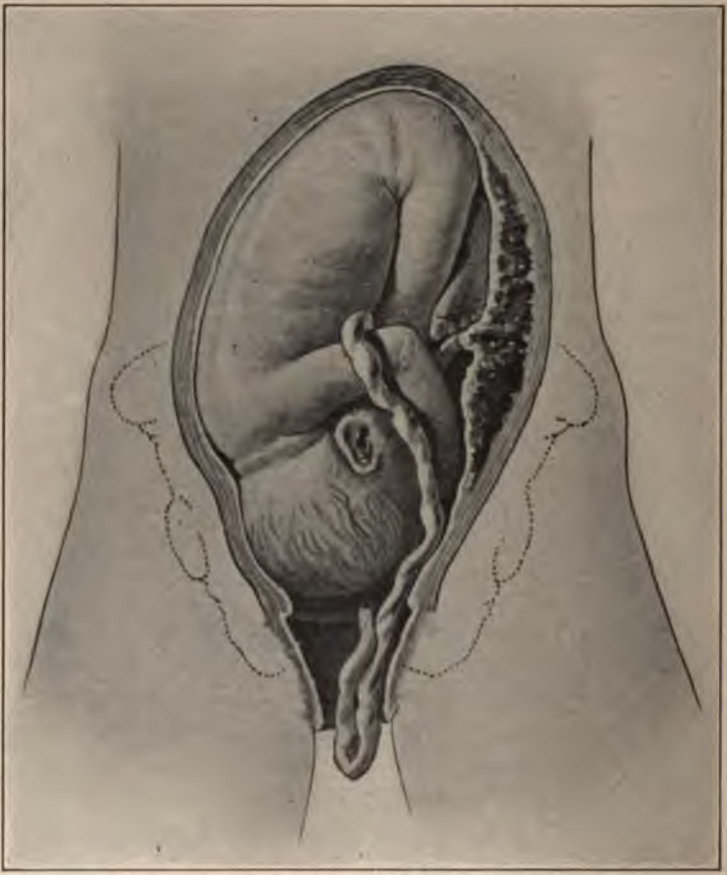


Fig. 125.—Prolapse of the umbilical cord. (Berkeley and Bonney.)

be followed by a recurrence, which, however, can be more easily treated by reason of the increased cervical dilatation.

If the absence of pulsations in the cord shows that the child is dead, labor should be allowed to proceed without interference, unless the mother's condition demands it.

INTRA-UTERINE ASPHYXIA

Intra-uterine asphyxiation of the fetus may result from any condition which leads to imperfect oxygenation of its blood. The first effect of such interference is an increased pulse rate, but later, as the brain centers become paralyzed, the heart beat becomes slower and finally ceases. Occasionally, this may result from compression of a loop of cord, but more frequently it is due to mechanical interference with the placental circulation, so that the fetus does not receive sufficient oxygen, as occurs in placenta previa, premature separation of the placenta and in tetanic contraction of the uterus. Finally, in prolonged labors and in operative deliveries, particularly forceps, the excessive pressure to which the head is subjected compresses the brain or causes hemorrhage, when the increase in intra-cranial pressure leads to slowing of the heart. Occasionally, this latter accident is associated with fracture of the skull, but it may follow relatively easy spontaneous labors. In either event, the child rarely responds satisfactorily to treatment.

Following prolonged anesthesia, the child may be born partially anesthetized and breathe poorly, while during morphin-scopolamine narcosis so much morphin may be transmitted to the child that it is born in a narcotized condition and breathes very slowly.

Occasionally, when pituitary extract has been administered to hasten labor, such prolonged and powerful contractions result that the proper flow of blood through the uterine vessels cannot take place. In this event, the fetus suddenly shows signs of asphyxiation and can be saved only by prompt delivery, followed by such resuscitative measures as are necessary.

Diagnosis.—Practically the only means available for determining the condition of the child *in utero* is by hearing and counting its heart sounds. Generally speaking, a rate below 100 or above 160 per minute between pains indicates fetal distress, while irregularity in rhythm or lack of tone sometimes gives important information, but none of these signs can be relied upon implicitly. Probably all of them are dependent upon pressure exerted upon the fetus during the uterine contractions.

When such signs are detected before delivery, certain of the children will not breathe spontaneously after birth, and will require strenuous efforts at resuscitation before respiration becomes well established. On the other hand, the fetal heart sounds may present no variation, and yet the child may be born deeply asphyxiated. It is therefore apparent that the relation between the condition of the fetus and its heart tones is subject to such discrepancy that didactic statements cannot be made.

In head presentations, the passage of meconium before delivery, as indicated by the escape of yellowish-green or tar-colored amniotic fluid, usually denotes asphyxiation. The escape of meconium is attributed to relaxation of the sphincter ani muscle induced by poor aeration of the blood. In breech presentations, on the contrary, this occurrence has no significance, because it is a mechanical result of pressure exerted upon the child's abdomen.

During asphyxiation, the child frequently makes respiratory efforts *in utero* and thus aspirates considerable quantities of amniotic fluid and mucus, which must be removed early in the course of any attempt at resuscitation. Very rarely, when there is air in the uterus or vagina, the fetus may make audible sounds in conjunction with its respiratory efforts—*vagitus uterinus.*

After delivery, two types of asphyxia are recognized: *asphyxia livida* and *asphyxia pallida.* In the former the child presents a congested or livid appearance, while, in the latter, it is pale, and limp, and presents no evidence of life except the slowed heart beat.

Prognosis.—The condition is always serious, and despite every effort many children will succumb. Asphyxia pallida is less amenable to treatment than the livid variety; while the existence of definite intra-cranial lesions makes the prognosis even more unfavorable.

Treatment.—In the milder cases of asphyxiation, it is only necessary to hold the child's head downward while the mucus is removed from its pharynx by means of a finger covered with gauze, and to stimulate respiration by vigorously rubbing the back and chest. Slapping with the hand may be more efficient, but may appear brutal to non-medical onlookers.

The severe cases demand prolonged attention. The most essential feature in the treatment is to maintain the body temperature, which is most easily effected by immersing the child in a bath at 108° to 110° F. with only the face protruding. While thus immersed, the throat can be cleared of mucus by a tracheal aspirator, or by means of a "blow out," with the following technic: A piece of gauze is placed over the child's mouth and the physician blows quickly through it, at the same time compressing the upper abdomen to prevent dilatation of the stomach. The mucus in the upper air passages is thereby forced out through the nostrils, and is wiped away with the gauze. While this is an efficient method of clearing the throat and nose, it is doubtful whether it ever effects direct expansion of the lung tissue.

Many methods of *artificial respiration* have been recommended, but there is a growing suspicion that most of them do more harm than good.

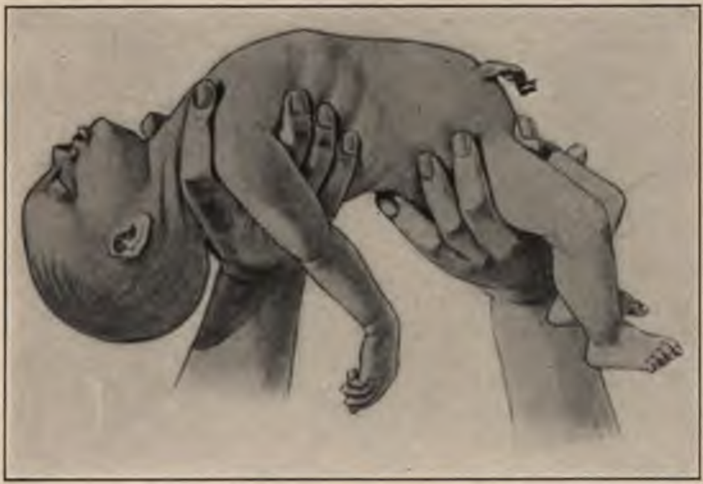


FIG. 126.—Byrd-Dew method of artificial respiration-inspiration. (Berkeley and Bonney.)

Gentle massage of the thorax six to eight times per minute, while the child is in the hot tub, is harmless and may be beneficial. Intermittent traction on the tongue by means of a small hemostat—*Laborde's method of resuscitation*—may be placed in the same category. On the other hand, procedures in which the child is swung through the air—*Schultze's* and *Cragin's methods*—are fundamentally wrong, in that they promote cooling of the body. Such a criticism does not apply, however, to the *Byrd-Dew method,* which can be practiced without removing the child from the warm tub. In this procedure, the head and shoulders are supported by one hand, while the thighs are grasped by the other, and by a "jack-knife" movement, the thorax is compressed and expanded at regular intervals for as long as may be necessary.

Mechanical devices for artificial respiration are strongly recommended by some obstetricians. The apparatus usually employed consists of a double pump by which fresh air or a mixture of air and oxygen is forced into the lungs through a tightly fitted rubber mask, while the vitiated air is withdrawn during "expiration." Such devices are probably correct in principle but their results are disappointing.

If gas and oxygen anesthesia has been used during delivery, asphyxiated children may frequently be rapidly revived by having the mother inhale several breaths of nearly pure oxygen before the cord is severed, for, as long as the placental circulation is intact, the oxygen absorbed by the mother's blood is readily passed on to the tissues of the baby.

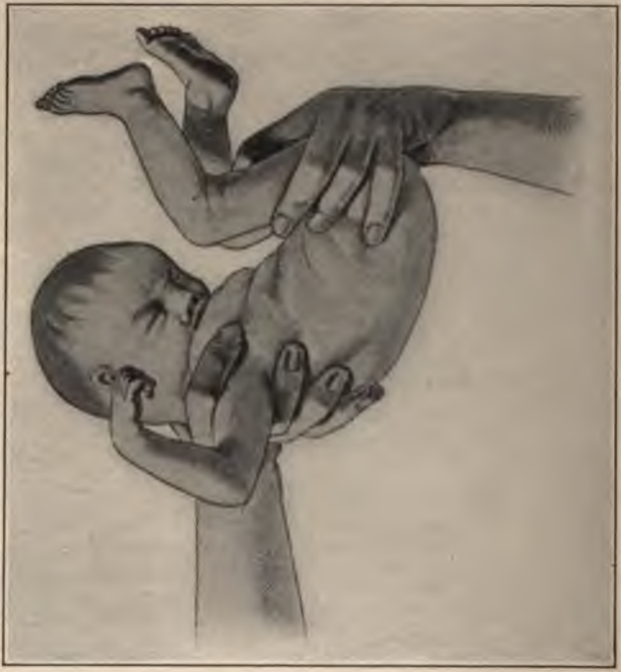


FIG. 127.—Byrd-Dew method of artificial respiration-inspiration. (Berkeley and Bonney.)

In the presence of a definite fracture of the skull, a decompression operation offers the best chance for permanent relief, if it is undertaken while the child's pulse is strong and regular, even though slow.

It will be noted that no mention has been made of the use of cold tubbing as a stimulatory measure. The reason is that the practice of immersing asphyxiated babies alternately in hot and cold water should be regarded as reprehensible except under certain definite conditions. Experience shows that cold applications are distinctly harmful until the child has begun to breathe regularly, but, after that, a quick plunge into very cold water will frequently lead to still deeper respirations and to lusty crying. If thus restricted, the procedure has a definite field of usefulness.

If spontaneous respiration is not established after ten minutes trial with the measures outlined above, the prognosis becomes very gloomy, but efforts at resuscitation should not be discontinued until the heart has ceased to beat, for occasionally even the most hopeless case unexpectedly responds to treatment.

ACCIDENTAL COMPLICATIONS OF LABOR

Various obstetrical complications, which have been discussed in the preceding chapters, may have a direct influence upon the course of labor, in that they may offer definite indications for interference in the interest of the mother. The operative procedures usually resorted to in such conditions have already been enumerated and need not be dwelt upon here. It should be understood, however, that under such circumstances, intervention is desirable in the effort to combat abnormalities on the part of the mother, and is unrelated to the more mechanical causes of dystocia, except that the unprepared condition of the birth canal may give rise to certain physical difficulties.

CHAPTER XVII

OBSTETRICAL OPERATIONS

Operative procedures become necessary so frequently in the proper conduct of various obstetrical complications that those who have to do with such patients should be informed regarding the more usual procedures and the indications for their employment. For obvious reasons, it will be impossible to describe any method in detail, so that emphasis will rather be laid upon the more general principles involved in the various types of operation.

General Indications for Operation.—In well conducted obstetrical practice, operative interference is never undertaken except in the presence of definite indications, which may be roughly classified as *maternal* and *fetal*. The former includes everything which threatens the life or well-being of the mother, and the latter, such conditions as endanger the child. The following list enumerates the most usual conditions in each group:

Maternal indications:

1. *Serious mechanical dystocia* due to contracted pelvis or to the presence of tumors.
2. *Prolongation of the second stage,* because of the increased danger of injury to the soft tissues of the pelvis.
3. *Exhaustion or intra-partum infection,* as indicated by a rise of temperature and pulse.
4. *Hemorrhage* from placenta previa or premature separation of the placenta.
5. *Toxemia of pregnancy,* when delivery can be accomplished conservatively.
6. *Pre-existing disease*—cardiac conditions, tuberculosis and other chronic diseases, and acute infectious processes.
7. *Miscellaneous group,* including various rare complications not specifically mentioned above.

Fetal indications:

1. *Intra-uterine asphyxiation,* as shown by changes in the heart rate or by the passage of meconium in cephalic presentations.
2. *Prolapsed cord* with its danger of serious asphyxia, unless promptly relieved.
3. *Abnormal presentations*—breech, transverse and face presentations.

Operative or Spontaneous Delivery.—Generally speaking, it may be said, with slight danger of contradiction, that it is better for a woman to deliver herself spontaneously under proper supervision than to be delivered artificially, unless conditions arise which can be conscientiously thought to prejudice her life or prompt recovery, or the chances of the child. This would place certain procedures, sometimes adopted for the routine delivery of women, outside the realm of reasonable obstetrics, since they introduce the dangers inherent in all operative methods. Any form of artificial delivery, by multiplying the possibilities of infection, not only leads directly to greater morbidity during the puerperium, which certainly carries the risk of serious consequences, but undoubtedly produces greater traumatism of the pelvic tissues, and thus predisposes to those conditions which so frequently follow lacerations. Reliable statistics likewise prove that such procedures considerably increase the danger to the child, so that the infant mortality is higher in a series of artificial deliveries than in an equal number of spontaneous births. Under the protection of modern aseptic and antiseptic technic, there has been a great increase in the number of instrumental deliveries and a coincident increase in the maternal death rate from infection, as is well illustrated by recent mortality tables. In many concrete instances, it may be impossible to demonstrate that one is the direct result of the other, but at least it should bring up the question as to whether the present tendency toward the operative termination of labor may not be productive of far more harm than good.

Preparation for Operation.—As a rule, obstetrical operations are emergency procedures, in the sense that the need for interference cannot be always foreseen. This necessitates constant preparedness on the part of the attendants, so that the least possible time may be lost after the need for operation has become apparent, since in certain instances a delay of only a few minutes may prove fatal to the mother or child. Consequently, the nurse should always be prepared for any contingency and should attempt to anticipate all reasonable demands. In a maternity hospital, the operating room should have available, (1) a well filled and boiling sterilizer, whenever a patient is in labor, (2) a plentiful supply of sterile dressings, basins and solutions, (3) hypodermic syringes filled with fresh pituitary extract and ergotole, (4) everything needed for packing the uterus and for giving an intra-uterine douche, and, (5) the proper materials for catheterization, for perineal preparation and for the use of the anesthetist. Moreover, as soon as more active preparations for delivery are begun, hot and cold tubs should be arranged for resuscitation of the baby, should that be necessary, and instruments and gloves should be sterilized by boiling.

Preparation of the patient is reduced to a minimum except when operations are performed at an appointed time, when the usual preoperative routine should be closely followed. Fortunately, interference usually becomes necessary only late in labor, so that little food has been taken for some time, and consequently, vomiting is uncommon during the administration of the anesthetic. When an enema has been given early in labor, the lower bowel will be relatively empty, but, if the time can be spared, it is advisable to give another before the patient is placed upon the table, since it reduces the danger of accidentally soiling the operative field with fecal material. If the child is alive, morphin is usually not given, as it may produce serious asphyxiation, but, if it is dead, its use simplifies the administration of the anesthetic.

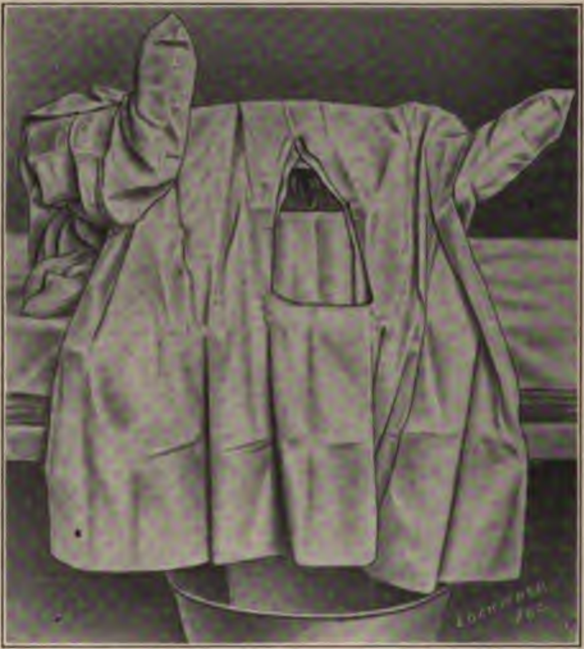


FIG. 128.—Patient draped for operation. (Williams.)

Although the simpler operations may be performed with the buttocks of the patient drawn to the side or foot of the delivery bed, it is more satisfactory, in hospital practice at least, to use a special operating table for all instrumental cases, since it frequently happens that the delivery may prove more difficult than was anticipated, when the best facilities available are none too good. The lithotomy position is used for all vaginal operations, the patient's feet and legs being supported by a convenient leg holder with a rubber pad beneath the buttocks and so arranged as to drain into a large basin on the floor. The chest and upper abdomen should be covered with a sheet and light blanket, while the arms are fastened securely alongside the body.

The lower abdominal wall, the inside of the thighs and the entire perineal region should be carefully prepared according to the usual technic and the region covered with a sterile towel until the operator is ready to replace it by the dressings. The bladder should always be emptied by means of a *rubber catheter* under strict aseptic precautions.

Complete surgical anesthesia is usually necessary, although a skillful anesthetist will vary its depth according to the procedure to be employed. Gas-oxygen may be used in certain instances, but when relaxation is essential, ether or chloroform is more satisfactory.

The operator should wear sterile gloves and gown, and, when thus prepared, should arrange the sterile towels and sheets so as to protect the operative field suitably.

For abdominal operations, the patient is placed flat upon the table with the arms at the sides and the legs and chest covered with warm blankets. When anesthesia is to be induced after the patient is on the table, the legs should be held securely by a broad strap and the hands should be confined. It should also be seen that the knees are so located with relation to the break in the table top that the patient can be placed in the Trendelenburg position without loss of time, whenever desirable. Catheterization is especially essential, and should be effected before the skin sterilization is begun. For the latter, careful preparation with tincture of iodin followed by ninety-five per cent alcohol has proved satisfactory. Sterile dressings are again applied by the physician after he is "clean."

OPERATIONS WHICH DO NOT EFFECT DELIVERY

The Vaginal Douche.—When a vaginal douche is given at the time of labor or during the first week of the puerperium, it should be considered a minor operative procedure, since, in order to avoid all danger of infection, it is essential to observe strict asepsis. For this purpose, the patient is placed upon a douche pan, and the perineum is prepared in the usual manner. The douche can and nozzle should be sterilized by boiling, and hand disinfection carried out conscientiously. Although the character of the solution used will vary according to circumstances, the three essential features are: (1) sterility of the fluid used; (2) its amount—two to four liters are usually recommended; and (3) its temperature—110° to 115° F. (43.0° to 46.0° C.).

As a rule, vaginal douches are little employed during pregnancy or labor, except in the treatment of acute gonorrhea, when it may be desirable to reduce the leukorrheal discharge in the hope of avoiding infection of the infant's eyes. During the first days of the puerperium douching should be done only at the express order of the physician, when it may be resorted to in order to remove offensive lochia, while later it promotes involution of the uterus, when that process is delayed.

The Intra-Uterine Douche.—Intra-uterine douches may be employed at the conclusion of labor in the presence of post-partum hemorrhage due to atony of the uterus, or when the patient has shown signs of intra-partum infection; whereas later in the puerperium they are indicated only by the existence of puerperal infection. In either event, the procedure should be conducted by the physician in charge under strict aseptic precautions.

After the usual perineal preparation, the patient should be placed upon a sterile douche pan and the thighs and legs covered with sterile towels. The cervix is exposed by means of a vaginal speculum and drawn downward until the external os is readily accessible. The douche nozzle is then cautiously inserted into the uterine cavity, which is thoroughly irrigated with large amounts of sterile hot water or normal salt solution. In the treatment of hemorrhage, the heat and the irritation of the nozzle tend to stimulate the uterus to satisfactory contractions, whereas, in infection, the mechanical action of the fluid removes the pus and débris. Antiseptic solutions are generally avoided as being ineffective and sometimes dangerous. Anesthesia is rarely, if ever, necessary.

Curettage.—*Instrumental curettage* is gradually losing its place in obstetrical practice, since it is being recognized that incomplete abortions, in which it was formerly employed, can be more satisfactorily treated by the digital removal of the retained portions of the product of conception; while, in most cases of infection, the operation does more harm than good. There is still, however, one valid indication for its employment, and that is in patients who continue to bleed for several weeks after delivery, as the result of subinvolution of the uterus incident to the retention of small fragments of placenta or membranes; but, as this condition generally subsides under the influence of ergot therapy, the operation can usually be avoided.

Digital curettage implies the removal of retained portions of placenta or membranes by means of the finger. This procedure has certain advantages over the more usual instrumental method, in that it permits more exact exploration of the uterine cavity and largely eliminates the danger of accidental perforation of its wall.

Either type of curettage demands aseptic preparation of the patient, operator and instruments, and, in the majority of cases, the administration of a general anesthetic. A preliminary dilatation is required whenever the cervical canal is too small to admit the instrument or the finger, as the case may be, and an intra-uterine douche is frequently given at the conclusion of the operation.

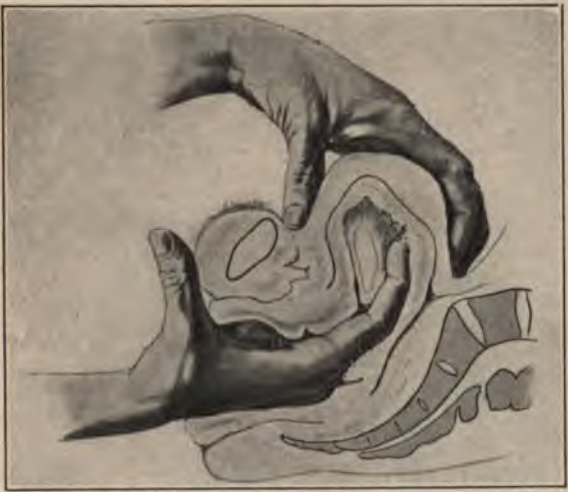


FIG. 129.—Digital curettage—incomplete abortion. (Bumm.)

The Tampon or Pack.—Packs made of three or four thicknesses of gauze, five to ten yards long and one to three inches wide, are ordinarily used in obstetrical practice. Since they are frequently needed in an emergency, a sterilized supply should always be available. The vaginal pack is rarely used, except to control bleeding from inevitable abortion, placenta previa or premature separation of the placenta, during the removal of the patient to a hospital, or following the insertion of a bougie to induce labor. On the other hand, a cervical pack is sometimes employed to induce labor, while the uterine pack is most useful in the control of atonic post-partum hemorrhage.

To pack the vagina, a speculum is inserted and the cervix steadied with a tenaculum forceps. The gauze strips are tightly packed in the fornices and gradually introduced until the entire vagina is filled. A cervical pack differs only in that the gauze is first passed into the cervical canal, after which the vagina is packed as before. Uterine packing is slightly more complicated in that the major portion of the pack is passed into the uterine cavity by means of a special dressing forceps. In either event, great precaution must be observed to insure strict asepsis, since the possibility of infection is considerable. For the same reason, a pack should be removed as soon as it has served its purpose, and under no circumstances should it be left in place longer than twenty-four hours.

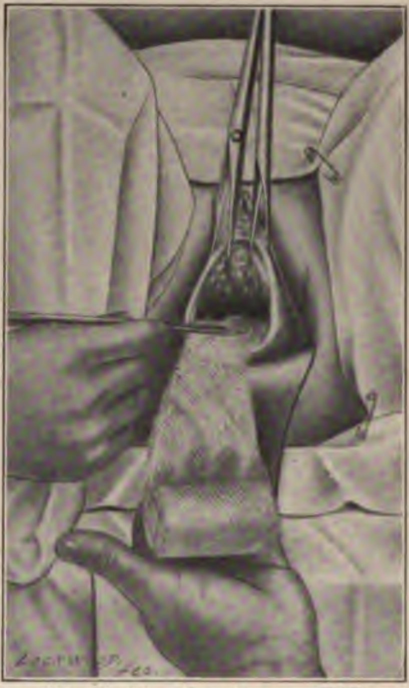


FIG. 130—Packing the uterus. (Williams.)

Manual Removal of the Placenta.—Occasionally, by reason of hemorrhages from the partially separated placenta, or when the placenta is abnormally adherent, it becomes necessary to remove it manually. For this purpose the patient should be anesthetized, and each step of the procedure carried out under the most rigorous aseptic technic. The operator's hand is passed along the umbilical cord into the uterine cavity, until the margin of the placenta is reached. Then, the back of the hand being in contact with the uterine wall, with a lateral motion of the fingers, the placenta is peeled away along the usual line of cleavage through the decidua, and, when completely separated, it is grasped by the hand and slowly extracted. From the standpoint of infection, this is the most dangerous procedure in obstetrical practice, since the hand comes in direct contact with the raw surface of the uterine wall. Consequently, very particular attention must be paid to all aseptic details, and the operation must be avoided, whenever possible, by the employment of less dangerous maneuvers.

The Bougie.—A bougie is a heavy walled rubber tube from one to two centimeters ($^2/_5$ to $^4/_5$ inch) in diameter, and 12 to 14 inches long, with a blunt end, and is used to inaugurate uterine contractions, when it is desired to induce labor, and when the cervix is not dilated sufficiently to admit a Voorhees bag. Its action is purely mechanical, in that it acts as a foreign body, which the uterus attempts to expel by its contractions, and in so doing quite incidentally terminates the pregnancy.

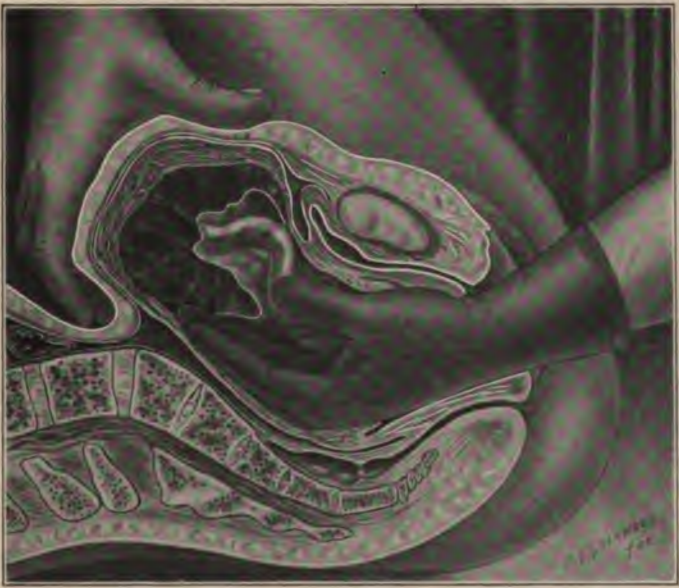


Fig. 131.—Manual removal of the placenta. (Williams.)

To insert a bougie, a vaginal speculum is introduced to expose the cervix, which is seized with a tenaculum forceps and drawn gently toward the vulva. The bougie is lubricated with vaseline and passed slowly through the external os and up between the membranes and the uterine wall until only a few inches remain in sight. Occasionally, two or even three bougies may be introduced simultaneously. A firm gauze pack in the vaginal fornix prevents the accidental expulsion of the bougie and also acts as an additional stimulus to the uterus. In the rare instances, in which the cervical canal is not sufficiently patulous to admit the bougie, preliminary instrumental dilatation must be effected.

Ordinarily, the procedure is attended by practically no pain, so that anesthesia is unnecessary, but in nervous women, it is advisable to administer gas and oxygen.

Labor usually sets in within twelve hours and intermittent contractions continue until delivery is effected. The bougie and pack are ordinarily expelled spontaneously relatively late in labor, but may be removed when the pains become regular and strong, without interfering with the progress of labor. In any event, even though it has failed to stimulate the uterus, the bougie should not be allowed to remain *in situ* for more than twenty-four hours, because of the danger of infection.

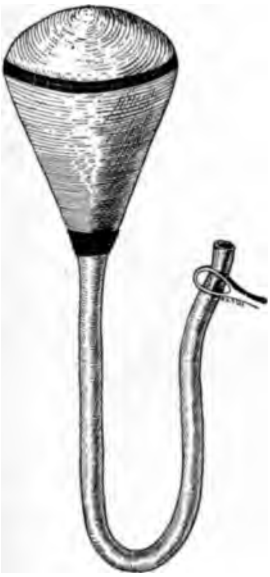


FIG. 132.—Voorhees rubber bag.

The Voorhees Bag.—The type of inflatable rubber balloon most commonly employed is the Voorhees bag (Fig. 132). It consists of a conical bag of rubber reinforced with fabric, with its apex terminating in a long, thick rubber tube. Such bags vary in size and may measure from one inch to four inches in the greatest diameter. They can be sterilized by boiling for five minutes, and, after using, care must be taken that the interior dries out thoroughly. When not in use, they should be kept lightly distended with air to prevent deterioration, and, even then, are so apt to become defective, that several of each size should always be kept in reserve.

Rubber balloons are perhaps most frequently employed as a substitute for the bougie in the induction of labor, and as a means of controlling hemorrhage in placenta previa. They are also used to facilitate cervical dilatation in cases of premature rupture of the membranes, where the presenting part cannot act as an efficient dilating wedge, and are of great value in the treatment of premature separation of the placenta.

For their introduction, the patient is placed in the lithotomy position and the cervix exposed by a vaginal speculum, and, if not sufficiently patulous, it must be dilated mechanically. After rolling the bag into the smallest possible cylinder, it is grasped by a specially devised forceps as shown in Fig. 133, and passed gently into the uterus well beyond the internal os. The applicator is then removed and the bag fully distended with sterile water by means of a Davidson bulb syringe or other similar apparatus.

If used to induce labor, the bag is inserted without rupturing the membranes, but, in placenta previa, the membranes or the placenta must be perforated, so that the bag can be placed within the amniotic cavity. If haste is essential, a weight should be attached to the end of the tubing and allowed to hang over the foot of the bed, so as to increase the pressure against the bleeding vessels and to hasten dilatation of the cervix.

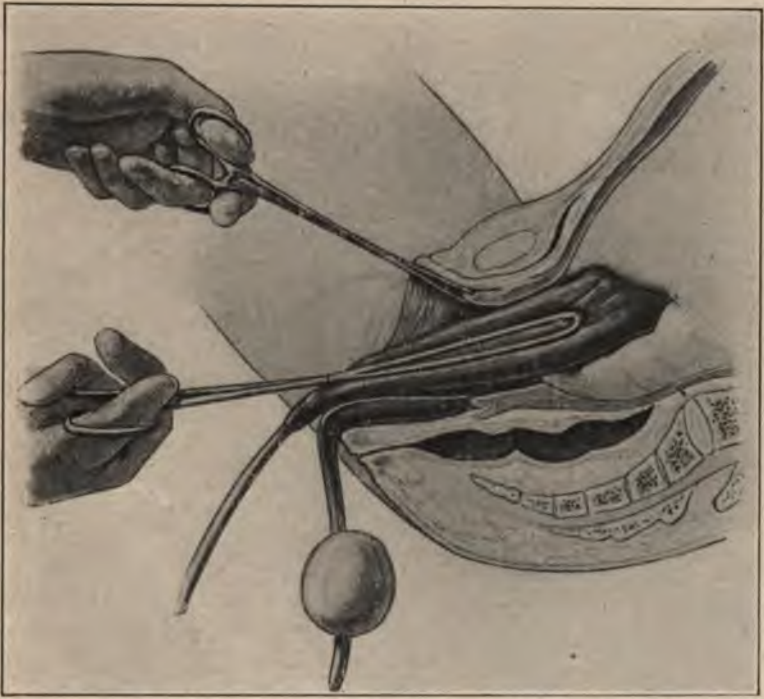


Fig. 133.—Insertion of rubber balloon. (Berkeley and Bonney.)

Bags generally excite strong uterine contractions very promptly, but if they fail to do so, they should be removed at the end of twenty-four hours, on account of the danger of uterine infection.

OPERATIONS WHICH FACILITATE DELIVERY

Episiotomy.—Episiotomy or incision of the perineal body for the purpose of increasing the size of the vulval opening, is employed mostly in primiparae with rigid perineal structures. The incision may extend directly backward toward the anus—*median episiotomy*—or obliquely to one or both sides between the ischial bones and the anus—*lateral episiotomy,* and is made by means of a pair of heavy scissors with one blade in the vagina and the other on the perineum. Following delivery, the incisions are closed with sutures just as in the usual perineal repair.

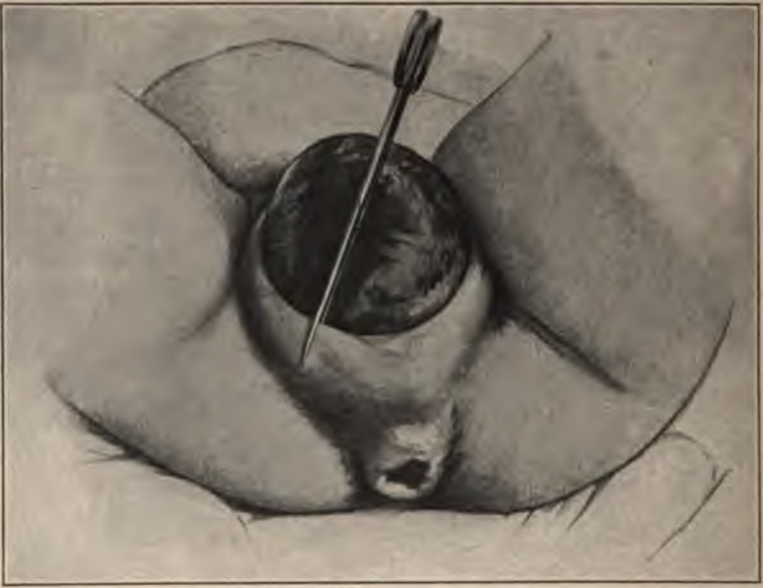


Fig. 134.—Episiotomy. (Bumm.)

The operation is chiefly practiced upon patients in whom it seems certain that spontaneous laceration of the perineum will occur, but may occasionally be employed to obviate the need for forceps delivery when delay is due to rigid soft parts. In the first instance, it is argued that the clean-cut incision heals more perfectly than the irregular spontaneous tear, but experience teaches that good results can be obtained in either event, provided the wounds are properly sutured and cared for.

Dilatation of the Cervix.—Forcible dilatation or incision of the intact or partially dilated cervix is frequently designated as *accouchement forcé,* a term which therefore includes all maneuvers designed to dilate the cervical tissues for the purpose of immediate delivery.

Instrumental Dilatation.—Instrumental dilatation is rarely employed in this country, except in early pregnancy, as a preliminary step in inducing or completing an abortion, or, later in pregnancy, in order to facilitate the introduction of a bougie or bag. In such circumstances, a small glove-stretcher dilator is employed, which accomplishes its object with small risk of tearing the tissues. On the other hand, it is inadvisable to attempt to dilate the cervix instrumentally at the end of pregnancy sufficiently widely to permit delivery of the full-term child, because of the practical certainty that it can be effected only at the expense of severe lacerations.

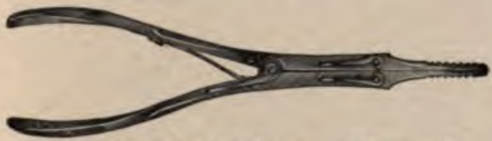


Fig. 135.—Goodell dilator. (Williams.)

Manual Dilatation.—Manual dilatation is a procedure well adapted to complete the dilatation of the cervix during labor, provided the canal has become obliterated and the resistance is offered by a softened external os. It has, however, no legitimate place before the onset of labor, nor before the conditions just mentioned are fulfilled, since it almost invariably leads to deep tears, which may extend into the lower uterine segment and result in death from hemorrhage or infection. When indications for immediate delivery arise in suitable cases, the patient is deeply anesthetized and the gloved hand passed into the vagina. The thumb and as many fingers as possible are introduced through the internal os, and dilatation is effected by pressure of the back of the thumb and fingers as they are separated and rotated. There is always a danger that the tissues will tear to some extent, but this possibility is reduced to a minimum if dilatation is effected as slowly and as gently as possible. As soon as the cervix is completely dilated, the child is delivered by the most appropriate means, after which the cervix is visually inspected for lacerations, which are promptly repaired if they are of considerable size, or if they cause bleeding.

Multiple Incisions of the Cervix.—Multiple incisions of the cervix are occasionally employed when the cervical canal is obliterated, but the external os is only partially dilated and is so rigid that manual dilatation seems contra-indicated. The incisions are made radially with scissors, and are carefully closed with catgut sutures following delivery. The procedure is rarely used because of the danger that tearing may extend beyond the ends of the incisions during extraction of the child, and may even go deeply into the broad ligaments, and give rise to considerable risk of serious hemorrhage and infection, not to speak of the difficulty which may be experienced in their repair.

Vaginal Hysterotomy (*vaginal cesarean section*).—Vaginal hysterotomy is an operation designed to enlarge the undilated cervix by carefully controlled incisions extending into the lower uterine segment. It is particularly useful when it becomes necessary to empty the uterus early in pregnancy, but is rarely employed during the latter months, because the large size of the child necessitates such an increase in the size of the incisions that abdominal cesarean section becomes the simpler procedure. It has the great advantage over other procedures employed for effecting a therapeutic abortion that the uterus can be emptied within a few minutes and does not entail forcible disruption of the cervical tissues.

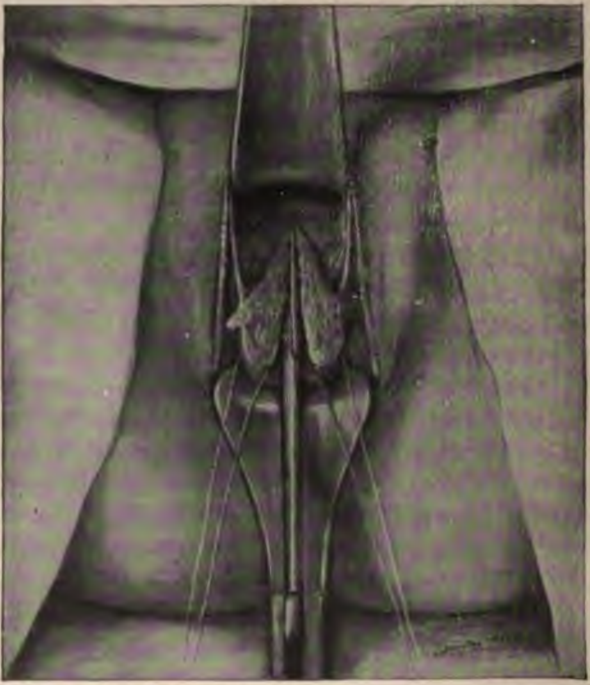


FIG. 136.—Vaginal hysterotomy—incising the cervix. (Williams.)

Its technic is as follows: The cervix is drawn toward the vulva by means of traction sutures of heavy silk passed through either side. A small transverse incision is made through the mucosa at the upper part of the vaginal portion of the cervix and is joined by a longitudinal one extending from a little above the urethra. Through these the bladder is separated from the cervix and lower uterine segment by means of a finger covered with gauze, and a large retractor is introduced to expose the lower anterior wall of the uterus, which is incised in the mid-line for several centimeters above the internal os. After rupturing the fetal membranes, the fetus is extracted and the placenta removed manually, after which the uterine wound and the mucous membrane are repaired with interrupted catgut sutures, and a small gauze drain placed between the two structures, which should be removed after twenty-four hours. Otherwise, the after-care of the patient is that of any other abortion.

When it is desired to utilize this procedure during the last three months of pregnancy, it is usually necessary to incise the posterior wall of the cervix and uterus as well, which necessitates opening the cul-de-sac of Douglas. In this event, the opening resulting from the two incisions will be sufficiently large to permit the passage of the head without danger of uncontrolled tearing occurring at the upper ends.

OPERATIONS DESIGNED TO EFFECT DELIVERY

Forceps.—The operation most commonly employed for the delivery of the child is extraction by means of the obstetrical forceps. Innumerable types of this instrument have been devised, but they all have the same general construction and differ only in minor details. The essential features are, the *blades* with a cephalic curve to fit the child's head and a pelvic curve to correspond to the axis of the pelvis, a *lock* to hold the blades in position, and a *handle* to each blade, by which traction can be made. The most important function of the instrument is traction, but it may be employed to rotate the head into a position more favorable for delivery.

Indications and Conditions.—Forceps delivery is the method of choice, when the head presents well down in the pelvis, and an indication arises calling for the artificial termination of labor. Before a safe application can be made, the following conditions must be fulfilled: (1) the child must present correctly—by the vertex or face; (2) the cervix must be fully dilated; (3) the membranes must be ruptured; (4) the head of the child must be neither too large nor too small, and (5) there must be no disproportion between it and the pelvis.

Varieties of the Operation.—Depending upon the position of the head in the pelvis, forceps operations are designated as low, mid, high or floating. See Fig. 137. *In low forceps,* the head is on the perineum and is usually visible upon separating the labia; in the *mid* operation, it is in the pelvis, but well above the perineum; in the *high* variety, it is engaged, but its greatest diameter has not yet entered the pelvic cavity, while in *floating forceps,* the head is freely movable above the pelvic brim.

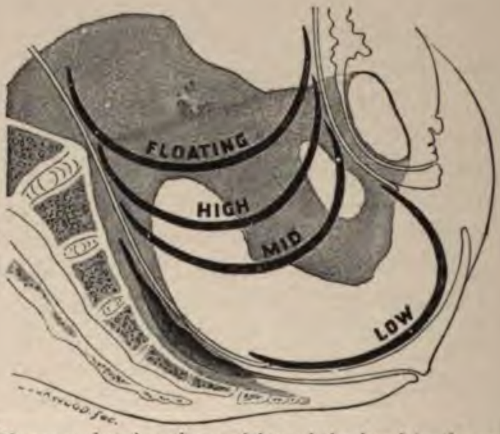


FIG. 137.—Diagram showing the position of the head in the various forceps operations. (Williams.)

Low forceps is usually quite easy and practically devoid of danger, whereas the mid variety is more difficult and should only be undertaken upon sound indications. The other two varieties are always difficult and are rarely performed, since delivery can usually be more satisfactorily effected by version and extraction, or some more radical procedure.

Application of the Forceps.—Owing to their peculiar shape, the blades must be introduced separately, and it is always desirable to apply them in such a manner that they grasp the sides of the head comfortably —*cephalic application,* although occasionally, it is necessary to ignore its exact position and to place one blade on each side of the pelvic cavity, irrespective of what portions of the head may be grasped—*pelvic application.*

Before the blades are introduced, the vaginal outlet is dilated manually until it will admit the clenched fist. A careful examination is made to see that the cervix is fully dilated and the membranes ruptured, as well as to determine the presentation and position. The child's ear, which is nearer the sacrum—the posterior ear, is located, and, under the guidance of the fingers, the corresponding blade of the forceps is applied over it. The other blade is then introduced and rotated until it can be articulated with the one already in position.

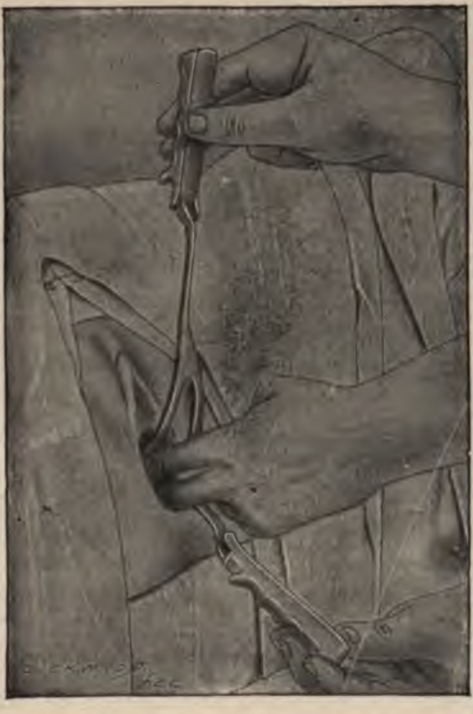


Fig. 138.—The application of forceps. (Williams.)

Intermittent traction is made and, in favorable cases, the head slowly descends, rotates and is delivered in a manner very similar to that occurring in spontaneous labor. The blades are usually removed as soon as the head is partially born and delivery completed by the Ritgen maneuver, described in a previous chapter. Extraction of the shoulders and body are effected as in a normal birth.

When the occiput is obliquely posterior (R. O. P. or L. O. P.), it should be rotated manually to a transverse or anterior position, and a single application made, but if this is not successful, two applications of the forceps are necessary—the *Scanzoni maneuver.* The first serves to rotate the head to the corresponding anterior position (R. O. A. or L. O. A.), while the second completes the rotation to O. A. and effects delivery.

Occasionally, in frank breech presentations, in which descent cannot be brought about by traction with the fingers in the groins, and in which the breech cannot be easily dislodged from the pelvis, the forceps may be applied over the trochanters of the femora. The application of forceps to the after-coming head is sometimes recommended, but is rarely necessary, if the Mauriceau maneuver is properly employed.

Prognosis.—The danger of forceps operations varies according to the position of the head. Low and mid applications have no appreciable maternal or fetal mortality, but high and floating forceps are distinctly major operations, with a definite mortality for both mother and child.

Even the simplest forceps delivery is not as satisfactory as a spontaneous delivery, and consequently, the increasing tendency toward the routine employment of the low forceps operation as soon as the head reaches the perineal floor reflects upon the critical judgment of the operator. Common sense, even without any technical knowledge, supports the contention that the natural way is the best, and statistical studies emphasize the greater percentage of perineal lacerations and of low grade infections, which follow the use of forceps.

Breech Extraction.—This method of delivery is employed whenever the child presents primarily by the breech, and also when an original cephalic or transverse presentation has been converted into a breech by podalic version. In the former, extraction is undertaken only after the normal powers of expulsion have shown themselves insufficient, whereas, in the latter, it is the rule to proceed with delivery as soon as the turning has been completed, inasmuch as the patient has already been anesthetized for that procedure.

The usual preparations are necessary. If one or both feet can be grasped, as in complete or footling breech presentations and in all cases preceded by version, traction is made upon them in a downward direction. After the buttocks have been delivered, the assistant or nurse makes pressure upon the lower abdomen in the direction of the axis of the superior strait, in order to keep the head flexed and to prevent the arms from becoming extended over it. Continued traction, aided by pressure from above, gradually brings the child down until the scapulae are visible. The arms are now delivered by rotating them from their position over the chest or above the head, as the case may be. It still remains to deliver the head, and, for this, the *Mauriceau maneuver* is generally employed. The index finger of one hand is placed in the child's mouth over the upper jaw, while the body rests upon the hand, and the buttocks straddle the forearm. Two fingers of the other hand are hooked over the shoulders and make downward traction, until the occiput comes under the symphysis pubis, when the child's body is raised toward the mother's abdomen, as the face and head gradually emerge over the perineum.

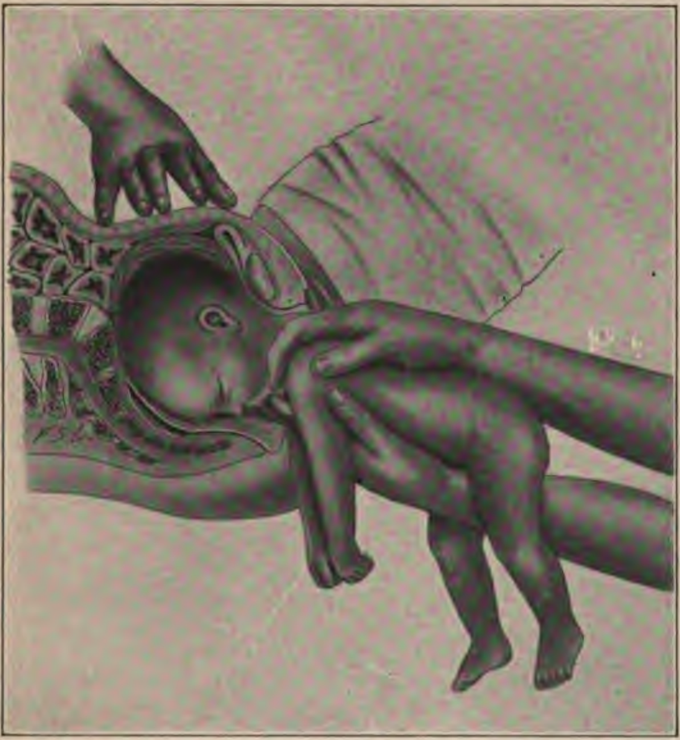


Fig. 139.—The Mauriceau maneuver—downward traction. (Williams.)

In the rare instances, in which the occiput rotates into the hollow of the sacrum, the *Prague maneuver* is employed. In it, one hand makes traction over the shoulders from below, while the other draws the feet up toward the mother's abdomen.

Frank breech presentations offer a complication, since the feet are not available for making traction. Occasionally, the breech may be pushed up out of the pelvis until it is possible to seize a foot, but more commonly traction is made by hooking a finger in the anterior groin and drawing the buttocks down, until a thigh can be grasped. Delivery is then completed as above.

The operation has no serious consequences for the mother, although perineal lacerations are somewhat more frequent, because of the necessarily rapid distention of the vulva, as well as of the efforts made to bring down the arms. On the other hand, the fetus is more likely to suffer from asphyxiation, as a result of compression of the cord between the after-coming head and the pelvic brim, when delivery is prolonged. On this account, a fetal death rate of ten per cent is not uncommon, even in the practice of excellent obstetricians.

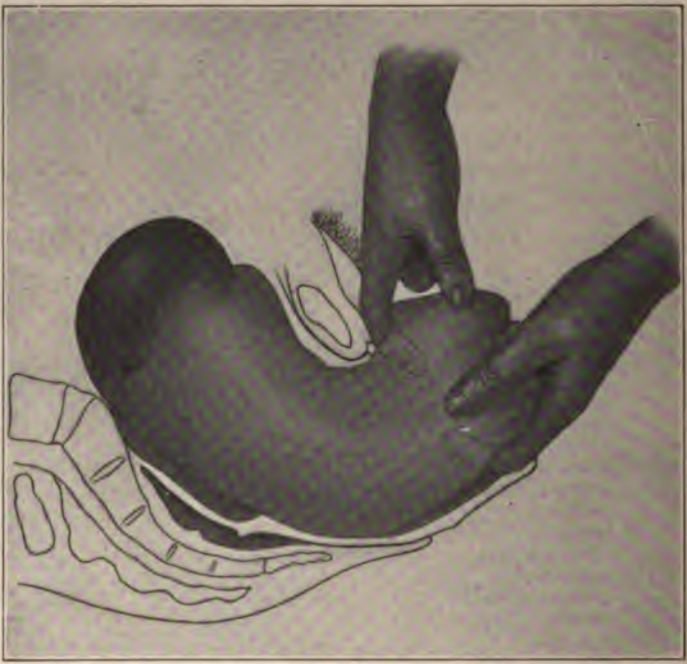


FIG. 140.—Extraction of frank breech—the fingers in the groins. (Williams.)

Version.—Version, or turning, is the procedure whereby the presentation of the fetus is altered, so that one pole is substituted for the other, or whereby a transverse or oblique is converted into a longitudinal presentation. Such changes of position frequently occur spontaneously during the early months of pregnancy, and may take place as late as the last month of gestation, but cannot occur after the presenting part has become engaged.

By suitable manipulations on the part of the physician, similar alterations may be effected artificially by several methods. Thus, *external version* is accomplished solely by manipulations through the abdominal wall; *internal version* by the entire hand introduced into the uterine cavity, while, in *combined version,* one hand manipulates externally, while two or more fingers of the other hand are passed through the cervix. According as the head or breech is brought to the superior strait, the procedure is spoken of as *cephalic* or *podalic version.*

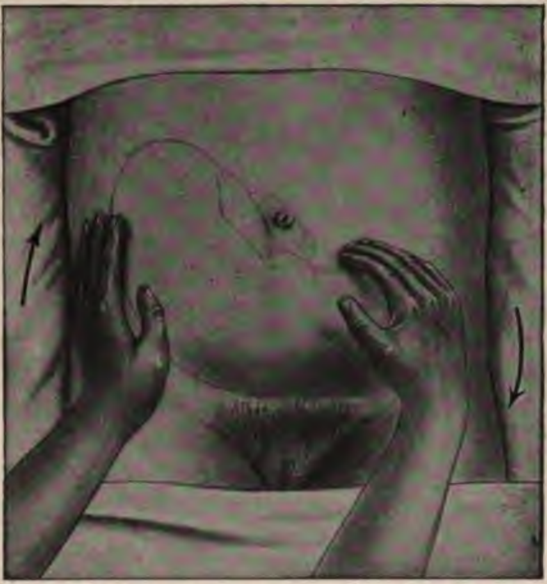


FIG. 141.—External cephalic version. (Williams after Pinard.)

External Version.—This operation is occasionally resorted to before the onset of labor, when it is desired to convert an unfavorable breech or transverse into a vertex presentation. For the manipulations to have any chance of success, the presenting part must not be engaged, and there must be sufficient amniotic fluid to permit ready movement of the child. Moreover, it is essential that the fetus be easily and accurately palpable and that the uterine and abdominal walls be not too thick or irritable. Under such favorable conditions, one hand gradually pushes the head toward the pelvic brim, while the other directs the breech toward the fundus. If this can be accomplished, suitable pressure pads and a tight abdominal binder are adjusted to maintain the child in the new position until engagement occurs. While external version can frequently be readily effected, the child tends to return to its original position, so that it is only rarely that the operation is practically successful; nevertheless, it should be tried whenever indicated.

Internal Version.—Internal version is indicated especially in transverse presentations, and may be the method of choice in cephalic presentations, when the head does not enter the pelvis even though there is no considerable disproportion. Additional indications are offered by prolapse of the cord, face and brow presentations arrested at the superior strait, and whenever the head has been pushed out of the pelvis, following manual dilatation of the cervix. It is contra-indicated in contracted pelvis, since the head will have to be mutilated before it can be drawn into the pelvis.

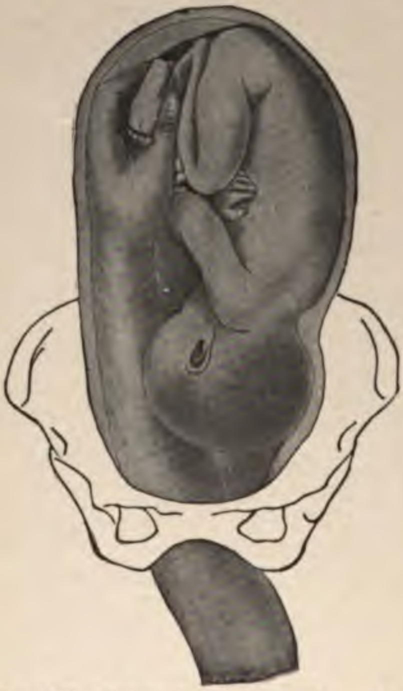


FIG. 142.—Internal podalic version—seizing the feet. (Williams after Tarnier.)

For the procedure to be successful, the cervix must be fully dilated, the uterus must be sufficiently relaxed to permit intrauterine manipulations, and there must be no disproportion between the head and the pelvis.

After the usual preparations, the entire hand is passed into the uterus, and one or both feet are grasped and drawn through the cervix, while the external hand pushes the head toward the fundus. The choice of the hand to be used internally varies according to the position of the child; if its back is directed toward the right side of the mother, the operator's right hand is preferable, and vice versa, since the palm thus faces the abdomen of the fetus and it is much easier to locate the feet. It is advisable to grasp both feet if possible, but if this cannot be done, the anterior one should be seized, because traction upon it tends to rotate the back anteriorly and thereby facilitates the final extraction of the head. In transverse presentations, the general rule is to bring down the lower foot, if the back is anterior, and the upper, if it is posterior. As soon as the turning is complete, breech extraction is performed as already described.

In suitable cases, the operation is easily performed, but, occasionally, as when the uterus is tetanically contracted, it may be impossible, or may lead to rupture of the uterus. Under favorable conditions, there is no maternal mortality, but delivery by breech extraction subjects the child to the risks attending that procedure.

Combined Version.—The combined operation is rarely performed, except in certain cases of placenta previa, where it is impossible to use a bag. One of the child's feet is drawn through the partially dilated cervix by the fingers introduced through the internal os, while the external hand pushes the head toward the top of the uterus. The buttocks are arrested by the cervical tissue and traction upon them effectually compresses the bleeding vessels. Under such circumstances, delivery should not be attempted until the cervix has become fully dilated.

The Scope of Internal Podalic Version.—Version and extraction is an exceedingly useful operation in selected cases, but should not be used as a routine procedure, as is recommended by certain enthusiasts. The chief objections to its performance, except under strict indications, are the inevitably increased fetal death rate incident to the dangers of extraction, and the greater liability to serious cervical and perineal lacerations on the part of the mother. Obstetricians who advocate its frequent employment appear to overlook the fact that they lose several times as many children as would be the case if they were more conservative.

Cesarean Section.—In this operation the child is removed from the uterus through an incision in the abdominal and uterine walls. Strictly speaking, the term should be limited to operations performed after the child has become viable, for, when performed in the earlier months of pregnancy, it is designated *Abdominal Hysterotomy.*

Various types of cesarean section are in use, as follows:

Conservative Cesarean Section.—After the delivery of the child, the uterine incison is sutured and the organ is replaced in the peritoneal cavity.

Radical Cesarean Section.—Usually the emptied uterus is amputated through the cervix as in a typical supravaginal hysterectomy, or more rarely the entire organ is extirpated.

Extraperitoneal Cesarean Section.—The abdominal wall and the uterus are incised and the child extracted, without opening the peritoneal cavity.

Vaginal Cesarean Section (vaginal hysterotomy).—This has already been considered.

Indications for the Operation.—There are only two conditions in which it is universally agreed that cesarean section should be done: (1) a pelvis so markedly contracted as to cause serious disproportion between it and the child, and (2) the existence of pelvic tumors, which so completely block the birth canal that vaginal delivery is impossible.

Pelvic Contraction.—If the contraction is so great that the conjugata vera measures 5.5 centimeters or less, the indication for cesarean section is *absolute,* since a full-term child cannot be delivered by any other means. When it varies between 5.5 and 7.5 centimeters, the need for the operation is only *relative,* because a dead child may be extracted after craniotomy, even though a live fetus cannot be delivered through the natural passages.

On the other hand, when the true conjugate exceeds 7.5 centimeters, the degree of disproportion determines the necessity for the operation. Thus, if after careful examination, the head seems too large and hard to pass through the pelvic brim, cesarean section *is the operation of choice,* even though the pelvis is normal. In such "border-line" cases, it is undertaken largely in the interest of the child, and should replace the more difficult and dangerous high forceps, version or craniotomy, which were formerly in vogue.

Pelvic Obstruction.—In exceptional instances, the pelvic cavity may become so blocked by a uterine myoma, an ovarian cyst, or by tumors of other origin, that abdominal delivery is rendered imperative.

Occasional Indications.—Depending upon the conditions prevailing in the individual patient, the operation may occasionally be indicated in placenta previa, premature separation of the placenta, eclampsia, nephritic toxemia and in decompensated heart conditions, as well as in neglected transverse presentations with a live child. Under such circumstances cesarean section is undertaken in the interest of the mother, in the belief that it offers a better prognosis than other methods of rapid delivery.

Abuse of the Operation.—From the standpoint of the operator, cesarean section represents the easiest possible method of coping with various obstetrical complications, and, for this reason, is constantly being performed without strict indication. Moreover, certain patients seem to prefer it to the slower and more painful spontaneous delivery, and thus readily accede to the doctor's suggestion that it should be done. If the operation did not seriously increase the danger to the mother, there is no reason why it should not become a matter of routine, and well-trained obstetricians would have relegated spontaneous delivery to its place among other antiquated procedures. But, and this is the essential point, all competent authorities agree that the operation still has a definite mortality, which must be reckoned with. Even under the most ideal conditions, at least one patient in each hundred cesarean sections dies as a direct result of the operation; while in the hands of the average operator, the death rate is many times that figure. On the other hand, the usual mortality attending uncomplicated spontaneous delivery is certainly not more than one-tenth as great. It is therefore imperative that cesarean section should be done only when strictly indicated.

Contra-Indications.—Even when the indications for cesarean section, which have been mentioned, are present, a number of circumstances may distinctly contra-indicate its use. Thus, it should not be done when the child is dead or in poor condition, except in the presence of an absolute indication, since, otherwise, craniotomy gives better results. Moreover, conservative section upon patients who have been long in labor, or who are already infected, is followed by so high a mortality, that it should be regarded as unjustifiable, unless one is prepared to follow it by amputation of the uterus. The extraperitoneal technic was devised to reduce the dangers in such cases, but the judgments regarding its supposed advantages are so conflicting that its field of usefulness has not yet been fully established.

The Conservative Operation.—The abdomen is prepared as for any laparotomy, but no attempts are made to "clean up" the perineum and no vaginal preparation is permitted. An incision 12 to 15 centimeters long is made through the mid-line of the abdominal wall, below, above, or at the level of the umbilicus, according to the predilection of the operator. As soon as the peritoneum is opened, gauze pads are placed about the incision to protect the abdominal cavity from blood and amniotic fluid, and the uterus is incised in the mid-line while still within the abdomen. The child is grasped by a foot, extracted as rapidly as possible, and, after cutting the cord between clamps, is passed to an assistant. Following delivery of the child, the uterus contracts down to a relatively small mass, and so compresses the vessels that the loss of blood is very moderate. The uterus is now delivered through the abdominal incision, unless this is situated too high to permit such a procedure, and the gauze pads are renewed. The placenta and membranes are then peeled away manually from their attachments, after which all bleeding usually ceases. As a matter of precaution, one cubic centimeter of pituitary extract may be injected into the deltoid region to insure firm contraction of the uterus. The incision in the uterus is now closed with two layers of catgut, care being taken to secure accurate approximation of the tissues, to exclude the decidua from the sutures and to tie them loosely. The uterus is then replaced in the abdominal cavity, and, after removing the free blood and clots from the peritoneal cavity, the abdominal incision is closed in layers as usual. Sterile dressings are applied and held securely in place by an abdominal binder.

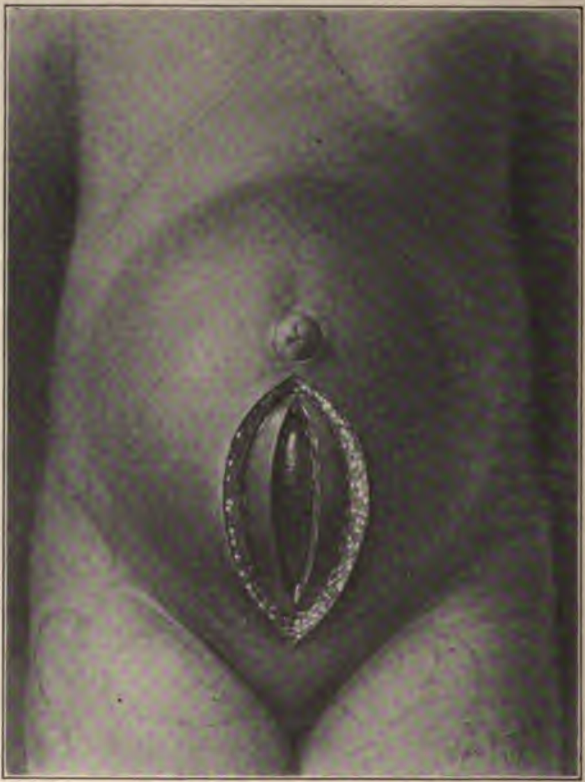


FIG. 143.—Cesarean section—the fetal membranes bulging through the uterine incision. (Williams.)

Post-Operative Care.—The general care after cesarean section does not differ from that following the usual laparotomy. The vaginal discharge is absorbed by vulval pads held in place by a T-binder, and the perineum is kept clean with warm water and soap, just as after a spontaneous labor. Suckling is not interfered with by the operation, but is not attempted until the milk secretion has become established, the child being given a weak milk formula in the meanwhile. Unless some complication arises, the wound is not dressed, nor the sutures removed, until the tenth day. The patient is allowed to sit up in bed on the tenth or twelfth day and to leave the hospital in less than three weeks. Fever is abnormal, so that slight elevations of temperature without definite findings usually indicate a mild infectious process.

Prognosis.—The ideal time for the performance of cesarean section is at an appointed time before, or immediately after, the onset of labor, and under such circumstances, the mortality should not exceed one or two per cent; but when undertaken late in the second stage, after the rupture of the membranes, it rises to ten per cent or more. Repeated vaginal examinations and previous unsuccessful attempts at vaginal delivery make the prognosis still more gloomy. In the fatal cases, death is usually due to general peritonitis or septicemia, resulting from a primary uterine infection.

Pregnancy Following Cesarean Section.—As conservative cesarean section has no effect upon the fertility of the patient, subsequent pregnancies are of frequent occurrence. The scar of the previous operation may furnish a source of danger in such cases, since it occasionally ruptures during the last months of gestation or at the time of labor. This accident more commonly occurs in patients whose convalescence from the first section was complicated by signs of a uterine infection. Although it is impossible to estimate the actual risk in any given case, it may be said that rupture will occur in not more than one per cent of the cases.

If the first section was necessitated by pelvic contraction or obstruction, subsequent pregnancies should be terminated in the same manner, inasmuch as the indication for it still persists. On the other hand, if it was performed for an accidental complication, such as eclampsia or placenta previa, a second operation would be indicated solely on account of the possibility of a rupture occurring through the old scar. The dictum—"once a cesarean, always a cesarean"—expresses the more usual feeling with regard to the course to be pursued, but it should not be accepted too literally, since experience teaches that the majority of such patients go through a subsequent vaginal delivery without serious accident. When it is considered that the danger of rupture through the old scar is probably not more than one or two per cent, and that when it does occur a large percentage of the patients recover following prompt operation, there is obviously little justification for a repeated section.

Radical Cesarean Section.—Cesarean section followed by supravaginal amputation of the uterus is employed (1) when the probability of a serious infection is too great to justify the conservative operation; (2) when it is desired to sterilize the patient; or (3) when the uterus is the seat of tumors or disease, which necessitate its removal. Convalescence is usually smoother than after the conservative operation, and the mortality rate is comparable to that obtaining in the latter procedure under the most ideal conditions, namely, one or two per cent.

Extraperitoneal Cesarean Section.—The true extraperitoneal operation is rarely performed in this country. It was especially designed for use in neglected or infected patients, in whom abdominal delivery is necessary, but in whom it is desirable to preserve the uterus. The operation is quite difficult, and the convalescence is frequently stormy, but the mortality is claimed to be lower than when the conservative operation is done under similar conditions. The procedures employed are too numerous and too complicated to be considered in this place. In the strictly clean cases, it cannot compete with the conservative operation.

Post-Mortem Cesarean Section.—When a patient dies during pregnancy or labor, and the child is still alive, the uterus may be opened immediately after the mother has ceased to breathe, in the hope of saving the child's life. This, however, is rarely successful. Asepsis is unnecessary and any available cutting instrument may be used.

Abdominal Hysterotomy.—This operation is in reality merely a conservative cesarean section in miniature, done before the child has become viable, that is, prior to the twenty-eighth week of intra-uterine life. The operative technic in the two procedures is identical and the same post-operative care is demanded. The operation is frequently combined with sterilization, when it seems that repeated pregnancy would seriously jeopardize the subsequent health of a patient suffering from an existing organic disease, such as chronic cardiac lesions, tuberculosis or chronic nephritis. Various methods are available for preventing the possibility of subsequent gestations, but the one most frequently employed consists in doubly ligating and cutting both fallopian tubes, and burying their uterine ends between the folds of the broad ligaments.

Pubiotomy and Symphyseotomy.—Pubiotomy and symphyseotomy are operations devised for temporarily increasing the size of the pelvis sufficiently to permit the extraction of the child, when the existence of moderate degrees of disproportion renders vaginal delivery impossible. In the former, the cartilage of the symphysis pubis is severed with a heavy knife, while in the latter, the pubic bone is sawed through with a Gigli saw. In either event, the ends of the pubic bones gape several centimeters, with the result that the pelvic cavity is so increased in size that delivery can be accomplished by forceps or version and extraction. These procedures are now so rarely employed that it is needless to describe their technic, and are practically limited to moderate grades of pelvic contraction, in which the degree of disproportion has been underestimated and the true extent of the dystocia only realized after a prolonged test of labor. In this event, these procedures may be utilized instead of sacrificing the uterus or the child.

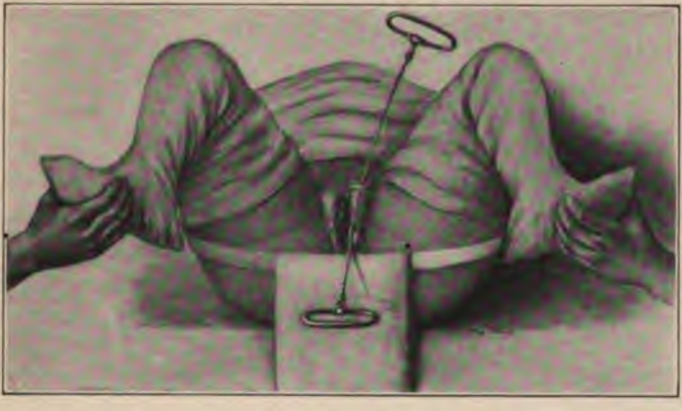


Fig. 144.—Pubiotomy—the Gigli saw in position. (Williams.)

These operations necessitate rather elaborate after-care, which includes the use of heavy bands of adhesive plaster around the hips, and the employment of a Bradford frame to permit the common nursing attentions. Patients are usually kept in bed three weeks, by which time fibrous union between the bones has become established, so that a normal life can be gradually resumed.

Destructive Operations.—These are formerly resorted to in many cases of obstructed labor, even though the child was alive; but, with the development of modern obstetrical surgery, the field for their employment has become limited to dead or deformed children, whose delivery would otherwise require some radical operation upon the mother.

Craniotomy.—This term includes all procedures in which the size of the fetal head is diminished by evacuating some of its contents through an operative opening. Smellie's scissors, as illustrated, are commonly used to perforate the head and are introduced through a fontanelle or suture and then break up the brain substance so that it can be washed out, after which the skull is compressed by forceps or by special crushing instruments and then extracted.

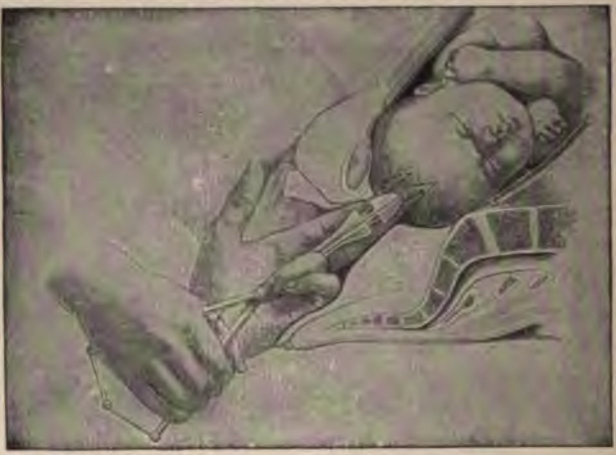


FIG. 145.—Perforating the head with Smellie scissors. (Williams after the American Text-Book.)

In hospital practice, craniotomy is practically never justifiably performed upon a living child, except in the presence of hydrocephalus, when it becomes the operation of choice; but in isolated districts, where conditions are unfavorable for radical surgical intervention, it may be the only means of saving the mother's life. Under such circumstances, it may be resorted to, unless the physician or patient has religious scruples against any attempt to save the mother at the expense of her unborn child.

Embryotomy.—This is a term used to embrace all other destructive procedures, and includes:

Evisceration, or the removal of certain thoracic or abdominal viscera through a wide incision. This is necessary only in certain monstrosities or when the fetus presents huge tumors of the internal organs.

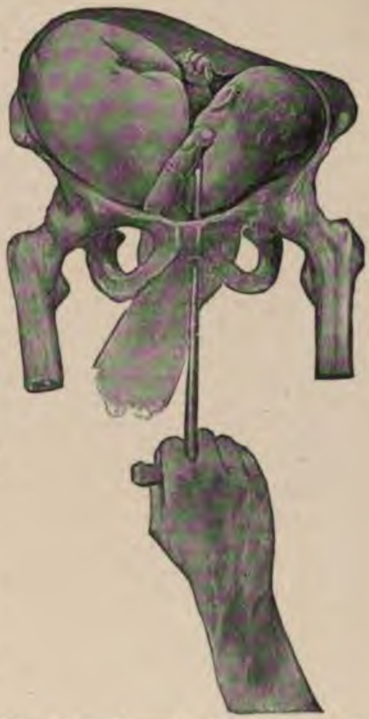


FIG. 146.—Decapitation with Braun's blunt hook. (Williams after the American Text-Book.)

Decapitation, or severing the head from the body by means of Braun's blunt hook or by heavy scissors is an operation the application of which is limited to neglected transverse presentations with a dead child. Under the guidance of the fingers, the hook is carefully placed over the neck, and, by a twisting motion, the cervical vertebrae are disarticulated and the soft tissues cut through, after which the body is extracted by traction upon an arm or leg. Delivery of the head is then effected either by pressure from above, by traction with the finger in the mouth, or by means of a crushing instrument.

Cleidotomy consists in dividing the clavicles for the purpose of diminishing the circumference of the shoulders. In very large children, and especially in those who are over-term, the shoulder girdle may be so much larger than the head that great difficulty may be experienced in extracting the body. In such cases, forcible traction will usually effect the release of the shoulders, but occasionally it is necessary to cut through one or both clavicles with heavy scissors before delivery can be effected.

CHAPTER XVIII

ABNORMALITIES OF THE PUERPERIUM

The puerperium is a period characterized by profound changes in the organs associated with the reproductive function, which render them especially susceptible to disease. The existence of the more serious of these complications is early indicated by elevations of temperature, so that fever at this time has come to be regarded as the most important symptom. As none of the physiological changes in themselves give rise to fever, our diagnostic efforts are largely directed toward ascertaining the cause of the pyrexia, since only thus can rational treatment be instituted.

Fever is always an early, and is usually the first, sign of puerperal infection, a disease with manifold manifestations, which is responsible for nearly one-half of all the deaths among parturient women, and which is also the most common cause of serious after-effects of child-bearing. Because of its frequency, as well as its gravity, all temperature elevations during the first two weeks of the puerperal period should be attributed to it, unless some other satisfactory cause for the febrile reaction can be discovered.

PUERPERAL INFECTION

This term embraces all abnormal conditions resulting from the entrance of pathogenic organisms into the generative tract during labor. The expressions "puerperal fever," "puerperal sepsis" and "puerperal septicemia" are frequently employed as synonyms, but are not so satisfactory, because they neither emphasize the infectious character of the disease nor indicate its varied manifestations.

For the past fifty years, it has been recognized that puerperal infection is usually a "wound infection," in the sense that the causative bacteria are introduced from without by means of the examining fingers, instruments or dressings. As has already been mentioned, the bactericidal properties of the vaginal secretion are so increased during pregnancy that the generative tract is kept free from the usual pyogenic organisms, so that "auto-infection" is a very uncommon occurrence. The single outspoken exception is furnished by the gonococcus, which may remain quiescent in the cervical glands throughout the gestation period, and then give rise to infection late in the puerperium.

The bacteria most frequently concerned in puerperal infection are the streptococcus, staphylococcus, colon bacillus, gonococcus, as well as certain saprophytic organisms. The streptococcus is the most common cause of serious infection, so that, when death occurs, it can nearly always be attributed to it. Occasionally, the typhoid bacillus, pneumococcus and other specific organisms, may be present in the lochial discharge, even though the patient presents no signs of a general infection.

Pathology.—Ordinarily, the offending organisms are introduced into the birth canal at the time of labor, and, after the expulsion of the placenta, find conditions in the uterus very favorable for their rapid growth. If the patient's resistance is unimpaired and the virulence of the bacteria is not excessive, the infectious process remains limited to the lining of the uterine cavity, and gives rise to an endometritis which is not particularly dangerous to life. On the other hand, if the virulence is high and the local reaction to the infection is imperfect, the process may spread to other regions, giving rise, according to the point of localization, to metritis, parametritis, salpingitis, phlebitis or peritonitis, or it may become generalized by the development of a septicemia or pyemia.

Perineal and Vaginal Lesions.—Occasionally, perineal or vaginal lacerations may become infected and give rise to ulcerated areas, which are covered with a dirty, greenish membrane and secrete a foul pus. Ordinarily, such lesions are associated with an endometritis, but occasionally they are entirely local. Because of their superficial character and the opportunity for free drainage, there is, as a rule, little systemic reaction, and consequently only slight danger of extension to other parts.

Endometritis.—The interior of the uterus at the end of labor, with its raw surface and clotted blood, forms an ideal culture medium for the growth of any organisms which may have been introduced into the birth canal. Under ordinary circumstances, the tissues react to this invasion by the development of a thick layer of leukocytes beneath the site of infection, which, by preventing further invasion by the bacteria, successfully limits the process to the endometrium. This is particularly the case with the putrefactive bacteria, colon bacilli and the less virulent pus-producers. In this event, the interior of the uterus becomes covered

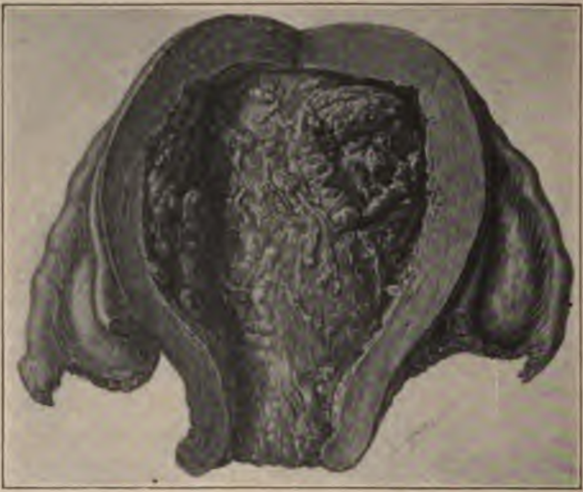


FIG. 147.—Uterus from patient dying from mixed infection—cavity full of necrotic material. (Williams.)

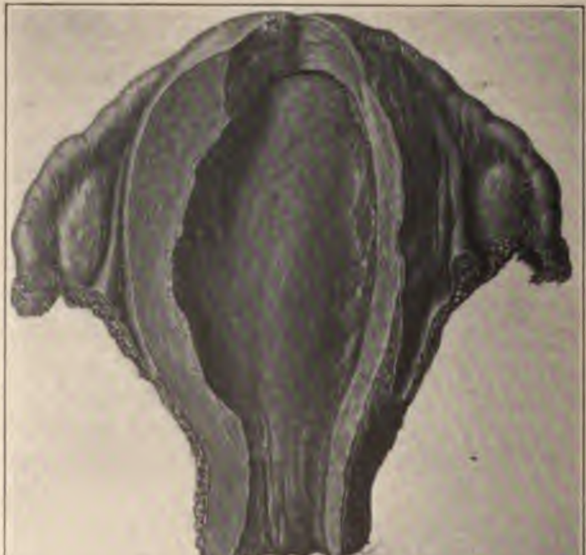


FIG. 148.—Uterus from woman dying from streptococcus infection—cavity clean. (Williams.)

with a thick layer of necrotic material and there is a profuse foul-smelling discharge.

With increased virulence of the bacteria or a diminished resistance on the part of the patient, such local reactions are less pronounced and the invading bacteria make their way into the uterine wall by way of the lymph channels. In this event, the uterine cavity is much cleaner in appearance, and there is relatively little discharge which may be devoid of odor. Streptococci are commonly responsible for this picture, and are therefore the most feared of the possible invaders, because the lack of effective resistance opens the way for their extension to the peritoneal cavity or into the blood stream.

Metritis.—In certain instances, the uterine wall may be invaded, the lesions varying from a slight infiltration of little moment to the formation of multiple abscesses. If the infection penetrates thus far, it is usually progressive and does not remain limited to the uterus, so that the metritis itself rarely explains the severity of the symptoms.

Parametritis.—Involvement of the connective tissue around the uterus, more particularly in the bases of the broad ligaments, is a frequent sequel to infection originating in the endometrium or in a cervical laceration. At first, there is a marked inflammatory reaction to the invasion, but its further course varies greatly. In some instances the process may subside spontaneously, while in others it goes on to abscess formation.

Salpingitis.—The fallopian tubes are rarely involved in infection with the ordinary pus organisms, but are a favorite site for the development of a gonorrheal process. In the latter event, it seems probable that extension occurs by continuity from the endometrium to the tubal epithelium. It is a well established clinical fact that symptoms referable to a gonorrheal infection do not appear until the second week after delivery. This is generally explained by the statement that the uterus harbors very few organisms and that signs of infection do not appear until they have multiplied; but more recently it has been argued that such an extension is mechanically impossible in the early part of the puerperium, since the uterine portion of the tube is blocked by the tightly contracted musculature of the uterus, whereas after partial involution has occurred its patency is restored and the avenue of infection is opened.

Phlebitis.—When the infection involves the thrombosed vessels at the placental site, it extends along the lining of the vessels, giving rise to a definite *thrombophlebitis.* This is rarely limited to the uterine wall, but usually extends beyond it and involves the great veins. Occasionally, the process is limited to the veins of the leg, when the condition is designated *phlegmasia alba dolens* or *milk leg*. When the thrombophlebitic process involves the larger vessels, it may even extend upward into the vena cava. This latter form is one of the common causes of death due to puerperal infection.

In certain cases of thrombophlebitis, small portions of the thrombus may break away into the blood stream and be borne to distant tissues, where they become lodged in the capillaries and produce metastatic abscesses—*pyemia*. Such abscesses are usually multiple, and no part of the body is exempt from them.

Peritonitis.—The majority of fatal cases of puerperal infection are attributable to this manifestation of the disease. The organisms concerned, most commonly streptococci, spread rapidly through the uterus by way of the lymphatics, and soon involve the peritoneum, where they become widely disseminated in consequence of the peristalsis of the intestines, and produce diffuse inflammatory changes. In such cases, the peritoneal cavity contains a greater or less amount of free pus, and the organs are glued together by fibrin and fresh adhesions. Rapid absorption of the toxic products of bacterial growth produces a violent constitutional reaction, and soon leads to death, which ordinarily occurs within ten days after labor.

Systemic Infection.—Occasionally, if the causative bacteria are unusually virulent, they fail to produce local lesions, but at once gain access to the blood stream, where they rapidly multiply. In this event, the resistance of the patient is rapidly overcome, so that she dies within a few days from a fulminating septicemia, when death must be attributed to the effect of the toxins upon the higher centers.

Etiology.—The question of the bacterial content of the vaginal secretion during normal pregnancy is still so unsettled that the possibility of so-called auto-infection by streptococci, which have led a parasitic existence in the vagina for weeks or months before delivery, cannot be denied, but, at the same time, clinical observation gives satisfactory evidence that in the great majority of cases, if not in all, the bacteria responsible for the infection have been introduced from without at the time of labor. Consequently, anything which is introduced into the birth canal during, or just before labor, may carry contamination with it, although the physician's hands and instruments are usually responsible.

Frequency.—It is impossible to estimate the incidence of puerperal infection among parturient women generally, but, even in well regulated hospital practice, from ten to twenty per cent of the patients have more or less elevation of temperature, which must be attributed to low grade uterine infection, though fortunately serious illness and death are rare, say one death to 500 deliveries. A natural tendency to explain these mild fevers upon the basis of other and less disturbing etiological factors has led many physicians to think that puerperal fever is an uncommon disease. Nevertheless, it is a fact that in 1918, 3473 women died from the disease in the birth registration area, which includes about one-half of the population of the United States, so that the mortality for the entire country was approximately 7000, which represent roughly 28 per cent of all deaths connected with child-bearing. Moreover, the evidence is conclusive that the death rate from this cause is steadily increasing. Consequently, if it were possible to include the cases, in which the fatal issue is attributed, upon insufficient evidence, to some other disease, the picture would be even blacker.

Available statistics concerning other infectious disease show a steady decline in the death rate, which offers a marked contrast to the slow increase in that due to puerperal infection. As has been indicated in another section, this may be partly attributable to the modern furor for operative delivery with the attendant risk of contamination; but at any rate it certainly indicates that preventive medicine is not producing the expected results among obstetrical patients. Every individual who handles obstetrical cases is in part responsible for this deplorable state of affairs, and it is only by facing the facts squarely that the results can be improved.

Symptoms.—The one symptom common to all types of puerperal infection is fever, and its degree and duration roughly indicate the severity of the process, while the time of onset frequently suggests the type of the organism chiefly concerned.

In severe cases of endometritis, the temperature rises suddenly on the third or fourth day to 102° to 104° F. (39° to 40° C.), and is usually accompanied by a feeling of general malaise, headache and frequently a definite chill. The uterus is found to be larger than normal for this period of the puerperium and is sensitive to pressure. The lochial discharge is somewhat increased in amount, but it may be quite devoid of odor. As a rule, the temperature remains elevated for some days or weeks, but gradually falls as recovery proceeds, unless the process spreads to other organs.

In milder infections, due to saprophytic bacteria, or to pyogenic organisms with slight virulence, the fever usually appears somewhat later and does not rise above 102° F. (39° C.). An accompanying chill is less common, but the other symptoms may be expected, while the discharge is profuse and foul-smelling. Within a few days, the fever and other signs disappear, so that the return to normal is but slightly delayed.

Spread of the infection is accompanied by other signs and symptoms, according to the localization of the secondary process. When extension to the parametrium occurs, the temperature, which has been gradually falling, rises again and becomes intermittent in character with evening elevations. At the same time, pain and tenderness develop in one or both broad ligaments, and an indurated mass becomes palpable on abdominal or vaginal examination. Ordinarily, the symptoms continue until the condition is relieved by operation, although occasionally spontaneous cure may take place with complete absorption of the exudate.

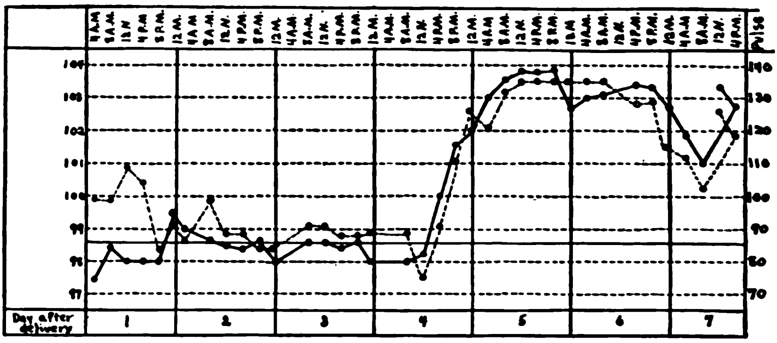


FIG. 149.—Chart showing temperature and pulse in case of streptococcus infection.

Involvement of the peritoneum is the most feared of all the eventualities, since treatment is of little avail. When virulent streptococci penetrate to the peritoneal surface of the uterus through the lymph channels, the patient soon shows signs of being extremely ill. The temperature is high and the pulse rapid, and in the latter stages of the disease, the two curves diverge so that the pulse becomes more rapid, in spite of a gradual fall in the temperature. This is a particularly bad sign and usually signalizes a fatal outcome. At first there is pain and tenderness only over the portion occupied by the uterus, but the entire abdomen soon becomes involved. Distention is usually present at this stage, and, in the absence of pain, may be the first sign to direct attention to the correct diagnosis. Occasionally, movable fluid can be demonstrated in the peritoneal cavity, and vomiting commonly occurs. In patients with general peritonitis, death usually ensues within ten days after delivery.

The patient gradually sinks, although loss of consciousness is rare until just before the end.

In the exceptional cases of true septicemia, the system is completely overwhelmed by the severity of the infection and the patient dies in shock within a few days, without the development of localizing signs. The serious condition of the patient should suggest the diagnosis, which can be accurately made only by the demonstration of the presence of bacteria in cultures made from the circulating blood.

Thrombophlebitis ordinarily appears during the second week after delivery. An initial chill accompanied by fever is commonly the first symptom, the latter soon becomes hectic in type with remissions followed by sudden rises. The symptoms attending the dislodgment of thrombi, which may be transported to various organs, depend so largely upon their final point of arrest, that it is impossible to detail them. The course of the disease depends upon the tissues thus secondarily involved, and, when vital organs are not affected, slow recovery may take place. An infectious bronchopneumonia is one of the commonest manifestations and frequently contributes to the fatal issue.

When the vessels of the leg are alone affected by extension from the pelvic veins—phlegmasia alba dolens—the picture is much more constant and the signs and symptoms are quite characteristic. In such cases, the first week of the puerperium may have been slightly febrile, or, occasionally, the temperature may have remained normal until the condition develops. The femoral, saphenous and popliteal veins are most commonly involved, and the first sign to attract attention is pain along their course. The involved vessels are sensitive to pressure and may frequently be palpated as hard cords under the skin. Intermittent fever of low grade is usually present, and the foot and leg on the affected side become edematous as a result of interference with the return flow of the blood. Convalescence is usually slow but complete, so that, within a month or so, the function of the leg is restored by the establishment of a collateral circulation. There is always some danger of fragments of the thrombus being broken off and carried to the lungs, when the patient will complain of pain in the chest due to the pleurisy, which is instituted, or occasionally may die suddenly from a large pulmonary embolism.

Diagnosis.—For practical purposes, it is best to ascribe all elevations of temperature appearing during the first two weeks of the puerperium to infection, unless some other perfectly reasonable explanation can be adduced. It was formerly thought that the establishment of the mammary function gave rise to fever beginning on the third or fourth day—

so-called "milk fever"—but the conception has been generally abandoned, since it has been demonstrated that bacteria are present in the uterine lochia. Furthermore, the tendency to ascribe such febrile reactions to constipation and to emotional causes is open to considerable suspicion. On the other hand, the demonstration of tonsilitis, bronchitis, pneumonia, pyelitis, mastitis, or any one of many other intercurrent diseases ordinarily associated with fever, may satisfactorily explain the temperature.

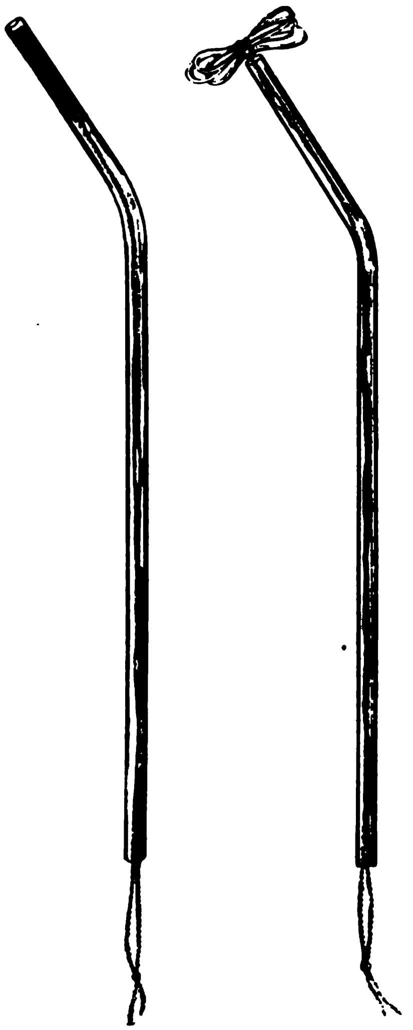


FIG. 150.—Uterine culture tubes. (Williams.)

Uterine Cultures.—As a matter of scientific interest and as an aid to diagnosis and prognosis, a culture may be made from the uterine lochia by the following technic: A culture tube, as illustrated, consists of a bent glass tube, through which is passed a strong silk thread with a few rubber bands tied on one end. This tube, together with a vaginal speculum and a tenaculum forceps, is sterilized by boiling. The patient is subjected to the usual perineal preparation, and, after being placed upon a sterile douche pan, is draped with sterile towels. Meanwhile, the physician, after sterilizing his hands, introduces the speculum, draws down the cervix and then passes the tube well into the uterine cavity. Traction upon the free end of the silk produces a partial vacuum and draws into the tube some of the lochia. Bacteriological examination of the material thus obtained will prove the presence or absence of bacteria; and, in the former instance, proper cultural methods will permit their identification. An intra-uterine douche of hot sterile water is usually given after the culture is taken.

In uninfected cases, the lochia obtained from the uterus will be found sterile for the first five or six days after delivery, but thereafter a gradual invasion by putrefactive organisms occurs, which renders the results obtained of no value. On the other hand, early in the puerperium, when serious infections usually begin, the procedure gives valuable information.

The time of onset and height of the fever, together with the severity of the symptoms, likewise indicate something of the nature of the process. Thus, a virulent streptococcus infection usually produces a febrile reaction to 103° to 104° F. (39.4° to 40° C.) on the third or fourth day, whereas the milder organisms produce a slighter elevation on the fourth, fifth or sixth days, while the gonococcus may only give rise to fever during the second week. Moreover, the early appearance of a rapid pulse, abdominal distention and vomiting always suggests a serious infection of streptococcic origin, which will probably extend beyond the uterus.

Treatment.—The cure of puerperal infection depends so largely upon the effectiveness of the natural powers of resistance of the patient, rather than upon active therapeutic measures, that prophylaxis is of greater importance than curative treatment.

Prophylaxis.—With the conception of puerperal fever as wound infection has come the knowledge that contamination from the outside is practically the only cause of the various manifestations of the disease. Accordingly, it is essential that as rigid asepsis be observed during the course of labor and early part of the puerperium as in major surgical operations, and that vaginal manipulations be reduced to the minimum consistent with the proper care of the patient. Everything used during vaginal examinations and at the time of delivery should be suitably sterilized in advance. The nurse is never justified in introducing anything into the birth canal, except under specific instructions from the physician.

Patients with severe streptococcic infection should be strictly isolated and the nurse who cares for them should be relieved from attendance upon other patients, especially upon those who are in labor. The danger of spreading infection among puerperal women is very much less than among those in labor.

No one having a boil or other suppurating lesion should be permitted in the delivery room, and it is likewise advisable to exclude those suffering with severe sort throat, since in many instances, the streptococcus which is responsible for it may be accidentally transmitted to the patient.

The General Treatment of Puerperal Infection.—All infected patients should receive general hygienic treatment, so that the full power of the natural mechanism of resistance may be available. This should include an abundance of nourishing food, with the administration of a bitter tonic, should the appetite lag. The patient should be kept in the open air as much as possible; when porches are available, the greater part of the day should be spent upon them, otherwise the bedroom windows should be opened widely. Excessive elevations of temperature (103° or over) call for the use of periodic sponge baths.

Supposedly curative measures, such as anti-streptococcus serum and various vaccines, as well as the employment of blood transfusion and the intravenous injection of collargol or silver nitrate solution have not fulfilled the expectations of those recommending them and are rarely of value.

Curative Measures.—Very little can be done to cure the serious cases of infection, but recovery from the milder forms may be facilitated by appropriate measures.

Infected Perineal Lacerations.—If the repaired perineum suppurates and breaks down, as occasionally happens, the sutures should be removed, so as to permit free drainage, while the area should be kept clean by irrigation with a weak antiseptic solution. When ulceration occurs, daily applications of half-strength tincture of iodin frequently result in rapid improvement.

Endometritis.—At the first sign of a uterine infection, an ice-cap should be placed over the lower abdomen and a course of ergot (six to eight doses at intervals of four hours) should be begun to encourage uterine contractions, with the idea of so compressing the lymph channels as to prevent the spread of the bacteria through the uterine wall. The diet should be liquid while the temperature is high, and a thorough evacuation of the bowels secured by a generous dose of a saline cathartic followed by an enema.

An intra-uterine douche of sterile salt solution or water is frequently given to wash out a certain amount of the infectious material and débris, as well as to promote uterine contraction. The addition of antiseptics to the douche fluid is ordinarily useless and may even be harmful. The employment of Dakin's solution has not been sufficiently extensive to justify positive statements as to its value. Some authorities recommend digital exploration of the uterine cavity before giving the douche, in order to remove whatever necrotic material is present. On the other hand, instrumental curettage is contra-indicated, since it tends to break down the leukocytic barrier, which normally counteracts the extension of the bacterial growth. When the infection is due to saprophytic bacteria the symptoms promptly disappear after a douche, but when more virulent bacteria are concerned, the response is usually less encouraging.

Parametritis.—When it becomes apparent that the broad ligament is involved, the use of external heat in the form of hot water bottles, and internally by vaginal douches of hot antiseptic solution is indicated. Occasionally, the process subsides under such treatment, but more usually it goes on to abscess formation and requires surgical treatment. Exceptionally, the pus cavity can be opened by vaginal puncture, but ordinarily it must be evacuated extraperitoneally through an oblique incision just above and parallel with Poupart's ligament, and a gauze drain introduced.

Thrombophlebitis.—Phlebitis of the large pelvic veins may be amenable to conservative treatment, while in other instances recovery does not occur until the infected vessels have been removed through an abdominal incision.

The more usual femoral phlebitis is best treated by rest. The patient is kept in bed with the affected leg elevated slightly upon pillows and cautioned to avoid moving it. When it is very sensitive, the bed clothes may be elevated upon a cradle. Cold applications are indicated during the early stages of the disease, to be followed by the use of heat when the infectious process is subsiding. Various local medicaments, such as ichthyol or lead and opium lotion are frequently recommended, but their value is questionable. Excessive pain should be relieved by opiates or other sedatives. The patient should not be allowed up until the swelling and temperature have subsided and violent exercise should be prohibited until the thrombus has become so thoroughly organized that emboli cannot be dislodged and until the collateral circulation is well established, which sometimes requires weeks or months.

Peritonitis.—When general streptococcic peritonitis develops, the prognosis is most unfavorable, as very little can be done except in the way of supportive measures. By the time the diagnosis has been made, the process has usually become so generalized that laparotomy with drainage, as a rule, only hastens the end. On the other hand, in gonococcal peritonitis spontaneous cure will generally occur without operation.

Septicemia and pyemia are not susceptible to either general or local treatment, so that the outcome will depend upon the ability of the patient to withstand a prolonged infectious process. In the latter condition, metastatic abscesses should be incised and drained whenever they are approachable.

OTHER DISEASES

Urinary Disturbances.—The *retention of urine* was discussed in Chapter IX, when it was said that this symptom should rarely complicate the puerperium if proper attention was paid to securing spontaneous emptying of the bladder.

Incontinence of urine is not uncommon among multiparous women with vaginal relaxation, and is especially apt to occur during coughing or sneezing, when the intra-abdominal pressure is momentarily raised. This is usually a transient condition, which disappears spontaneously within a few days. On the other hand, when a vesicovaginal fistula has developed as the result of trauma sustained during labor, the incontinence is more persistent and annoying. Spontaneous recovery occasionally occurs, but usually surgical intervention is essential to its repair.

Cystitis.—Cystitis originating during the puerperium is usually due to bacterial contamination resulting from catheterization. As the mucous membrane of the bladder is frequently injured to some extent during labor, it is more than usually susceptible to infection, so that the use of the catheter should be limited to such women as are unable to void. With proper encouragement by the nurse, it will be found that remarkably few patients will require catheterization.

Cystitis produces the usual symptoms of frequent, painful urination, and the bladder and urethra become sensitive to pressure. The detection of bacteria and pus cells on examination of the urine confirms the diagnosis. Fever is not a prominent symptom unless the upper urinary tract has become involved. The ordinary treatment—forced fluids and alternations in the reaction of the urine—usually results in prompt recovery, so that bladder irrigations or instillations are rarely necessary.

Pyelitis occasionally develops by the upward extension of the infection along the ureter and produces the symptoms described in Chapter XIII. The treatment there recommended is generally successful.

Diseases and Abnormalities of the Uterus.—The uterus undergoes such extensive and rapid alterations during the puerperium that it is especially susceptible to abnormalities, many of which are directly associated with these changes. Aside from the lesions resulting from the introduction and growth of pathogenic organisms, certain other conditions may supervene and demand attention.

Subinvolution.—When the uterus fails to return to its normal dimensions within the usual period, the condition is designated as *subinvolution*. This is ordinarily the result of local conditions, among which the following may be mentioned: uterine infection, retention of portions of the after-birth, uterine myomata, displacements of the uterus, especially retroversion, chronic pelvic inflammatory disease, and too early rising after delivery.

Subinvolution is evidenced by the persistence of a bloody discharge for the longer period than usual, followed by profuse leukorrhea and dragging sensations in the pelvis and back. Upon vaginal examination, the uterus is found to be larger and softer than it should normally be at that particular interval after delivery, and it is frequently possible to detect the presence of one or more of the etiological factors named above. Unless the condition is promptly relieved, permanent changes may occur in the uterus, which will eventually make its removal necessary in order to check the resulting metrorrhagia. In general, women who suckle their children are much less likely to develop subinvolution than those who for any reason are unable to do so. This relationship between functional activity of the mammary glands and involution of the uterus is not understood, but is nevertheless capable of clinical proof.

The medicinal treatment of subinvolution consists in measures designed to relieve the congestion which invariably accompanies it; more particularly by stimulating more intense contraction of the uterine musculature and by improving the circulation of the blood through the pelvic vessels. For this purpose, a course of ergot (six or eight doses at four-hour intervals) is administered and copious, hot, vaginal douches are given twice daily. In many uncomplicated cases this results in the prompt disappearance of the symptoms, but, if local lesions are present, they must be corrected or relieved before a cure can be effected. Thus, if the uterus is retroflexed, it should be restored to its normal position and held in place by a pessary, while, if the endometrium is diseased or if fragments of the after-birth have been retained, curettage is indicated.

Lactation atrophy.—In women who suckle their children, the uterus usually involutes so rapidly and completely that it becomes smaller than the virginal organ within six weeks. This condition of *superinvolution* or *lactation atrophy* usually persists for only a few months, so that the uterus regains its normal size before or soon after the child is weaned. In all probability, lactation amenorrhea is due in part to this phenomenon, since the menstrual function is ordinarily re-established as soon as the atrophic condition ceases to exist. Very rarely, when lactation is continued for unusually long periods, the uterus may fail to regain its normal size and menstruation may cease permanently, thus producing an early menopause.

Displacements of the Uterus.—The large size of the early puerperal uterus combines with the inevitable relaxation of its ligamentous supports to make the organ especially susceptible to outside pressure influences, so that displacements are commonly observed after delivery.

Anteflexion is the normal position of the uterus after the first few days of the puerperium, just as in the non-pregnant state, but occasionally it may become so exaggerated as to interfere with the escape of the lochia. In such circumstances, the uterus may become the seat of a saprophytic infection, which will give rise to general manifestations —fever, chill and malaise—unless quickly relieved. Ordinarily, this occurs spontaneously with the evacuation of the purulent material, but, otherwise, an intra-uterine douche affords the best method of treatment, since it mechanically removes the infected material and prevents further absorption of its toxic products.

Retroversion or *retroflexion* is impossible until the uterus has become so diminished in size that it can sink past the promontory of the sacrum into the pelvic cavity. Usually, the supporting structures, which ordinarily maintain it in ante-position have by that time regained their tone so that the organ retains its normal position; but when they are relaxed, the fundus tends to fall back into the hollow of the sacrum. This condition, which rarely develops before the third week after delivery, is usually associated with an increase in, or a return of, the lochial discharge, and may be accompanied by pain in the back and lower abdomen. It is detected on vaginal examination, and as soon as the diagnosis is made, the organ should be restored to its normal position and held in place by a pessary for three or four months, until the peri-uterine structures are able to maintain it in normal position without such assistance. While a pessary is in place, cleanliness should be assured by vaginal douches of warm water two or three times a week.

Vaginal relaxation and prolapse of the uterus always seem more marked in the early part of the puerperium, so that the exact extent of the abnormality cannot be determined until the structures have had an opportunity to involute thoroughly. Both conditions are undoubtedly due to lacerations occurring at the time of labor, although occasionally the injuries may be entirely unsuspected at that time, because of the absence of visible tears. In general, it may be said that, unless the condition is particularly annoying, it should be treated by palliative measures, until the child-bearing period is passed, when permanent relief can be secured by surgical procedures. When, however, the symptoms are so urgent as to necessitate operation before that time, special consideration should be given the possibility of future labors.

Delayed Chloroform Poisoning.—Whenever prolonged chloroform anesthesia is used during labor, there is a certain danger of delayed poisoning. The condition develops only in a fractional percentage of patients, who appear to have an idiosyncrasy to the drug, as is evidenced by the fact that they are peculiarly resistant to its anesthetic action, so that unusually large quantities must be administered. Even in such patients, if the chloroform has not been administered for longer than half an hour, there is but slight chance that detectable symptoms of poisoning will develop.

Clinically, the patient does well for the first two or three days after delivery, but then develops jaundice and mental symptoms, which may gradually wear off, or which may increase in intensity until death occurs in coma. Pathologically, there is a severe necrosis of the liver lobules, which is largely localized around the central veins.

Puerperal Neuralgia and Paralysis.—During labor many women complain of pains which shoot down one leg or the other. As a rule, such cramps are present on the side corresponding to that occupied by the occiput of the child and are completely relieved by its birth. They are ordinarily attributed to pressure exerted upon the nerves supplying the lower extremities as they pass over the brim of the pelvis. After prolonged and difficult labors, they may persist for days, but usually disappear spontaneously. In very rare instances, however, the injury is permanent and produces paralysis of certain muscles of the leg. In the less severe cases, treatment is unnecessary except for the administration of mild hypnotics to induce sleep, while in the paralytic cases neurological therapy is alone of value.

Sacro-Iliac Relaxation.—As a result of the hyperemia incident to pregnancy, the pelvic joints become looser than normal, so that greater motility exists between the sacrum and the iliac bones. Ordinarily, this disappears shortly after labor, but, occasionally, and especially following difficult deliveries, it persists and produces a fairly definite train of symptoms, including pain in the lower part of the back, which is more annoying late in the afternoon or after unusual exercise, and a general feeling of weakness. Pressure over the sacro-iliac region elicits a localized tenderness, and flexion of the extended leg reproduces and accentuates the usual backache. Pelvic examination reveals no condition which might cause the symptoms, but the X-ray may show an actual abnormal separation in one or both joints. Strapping the lower part of the back firmly with broad bands of adhesive plaster, which extend over the iliac crests in front, will give temporary relief, but for permanent support a special belt or corset is preferable. After wearing such an appliance for several months, the ordinary corset may be resumed with little danger of a recurrence of the symptoms.

Abnormalities and Diseases of the Breasts.—*Supernumerary breasts* are relatively common, although, as a rule, they exist only as minute pigmented moles symmetrically placed over the thoracic or abdominal wall. Accessory breast tissue, usually without nipples, is quite frequently observed in the axillae, where it may lead to considerable discomfort when the mammary secretion is becoming established. Very rarely, several extra functioning breasts may be present. Treatment is usually not necessary, as the glands soon cease to function if they are not stimulated.

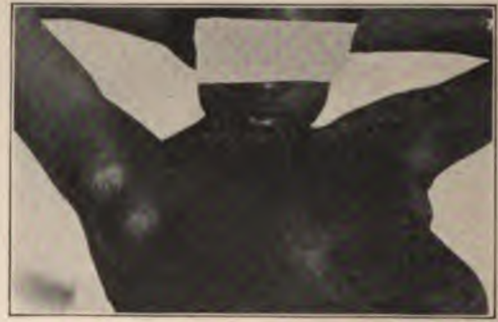


FIG. 151.—Accessory breasts (axillary).

Depressed and cracked nipples have been discussed in Chapter IX.

Simple mastitis is the result of the entrance of pyogenic organisms into the mammary gland, so that an acute inflammatory process is set up, which may lead to pus formation, unless adequately treated. Such infections are usually secondary to cracked nipples, but may occasionally develop in the absence of visible defects in the superficial layers of the skin. The condition rarely occurs before the second week after delivery, but from then on may develop at any time during the lactation period. The symptoms consist in a sudden, sharp rise of temperature and pulse, frequently accompanied by a chill, at which time the patient complains of pain in the breast, and palpation reveals a sensitive nodule of varying size with the overlying skin considerably reddened and hot to the touch.

Prophylactic treatment consists in preliminary care of the breasts during pregnancy and in prompt care of all fissured nipples, so as to prevent the entrance of bacteria into the deeper tissues. At the first sign of definite mammary infection, the affected breast should be emptied by means of a pump and compressed firmly against the chest wall by a tight binder. Ice caps are applied constantly to diminish the milk secretion and to limit the spread of the infection. The baby should not nurse from the breast, and massage should not be instituted; but the excess secretion may be removed from time to time with a pump, which entails very little manipulation. When response to this treatment is satisfactory, the temperature falls to normal within forty-eight hours and the symptoms disappear. If, however, marked improvement is not apparent within that interval, it is probable that an abscess has developed. Ordinarily, the appearance of the latter complication is due to the lack of proper attention on the part of the nurse, since conscientious treatment of the early condition will generally result in abortion of the infection.

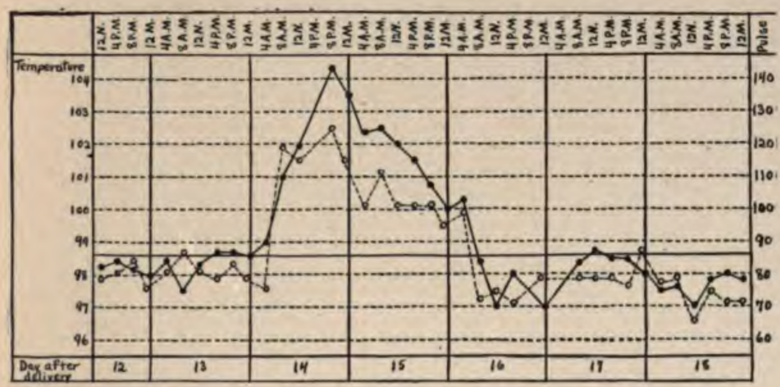


FIG. 152.—Chart showing temperature and pulse in case of simple mastitis.

Suppurative mastitis follows as a direct result of a simple inflammatory process, when the latter has not been treated or when the treatment has been ineffectual. In such cases, the temperature remains elevated and the palpable mass becomes fluctuant. In doubtful cases, the suspected nodule may be aspirated with a needle to determine the presence of pus. As soon as a diagnosis is made, the abscess cavity should be widely opened, preferably under general anesthesia, by a radial incision, after which the pus pockets should be broken up with the finger and a gauze drain inserted. When the upper portion of the breast is involved, the incision should, for cosmetic reasons, be made as low as possible. Daily dressings are required and the drain should be removed only as the cavity fills with granulation tissue from below. Unless the condition is promptly treated, there is considerable danger that it will extend rapidly, when it may involve the entire gland, which will be rendered permanently functionless. Nursing should, of course, be stopped, and, as a rule, the gland becomes inactive within a few days, while the unaffected breast may hypertrophy sufficiently to supply milk for the child or may at least be able to furnish the greater part of its required nourishment. Attempts to reinstitute the milk secretion after healing is complete are rarely successful.

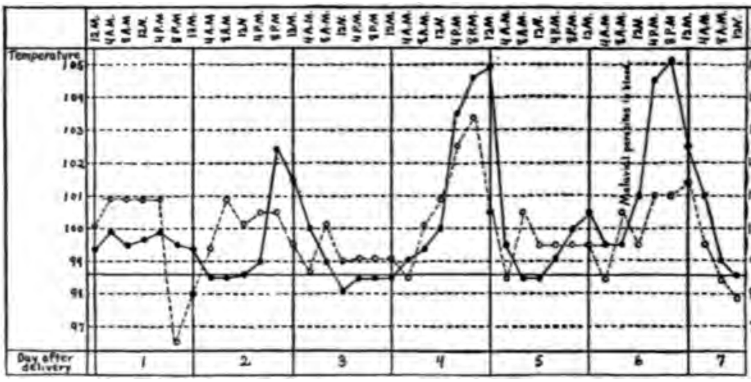


FIG. 153.—Chart showing typical temperature curve due to post-partum exacerbation of chronic malaria.

Puerperal Psychoses.—The development of a definite psychosis during pregnancy is rare, but such a condition appears about once in every 1000 women during the early part of the puerperium. Infection and toxemia are the most frequent predisposing factors, although there must probably be an underlying mental instability. As a rule, such patients are greatly excited and may become maniacal. Hallucinations are common. When the condition follows a toxemia, recovery usually occurs within a few days or weeks, but the post-infectional cases are more apt to prove permanent, so that one-quarter to one-half of them will require institutional care for prolonged periods.

Immediate treatment consists in the administration of sedatives as required and in extra precautions to prevent self-inflicted injury. If improvement does not follow within a few days, a competent psychiatrist should be consulted and the patient should be referred to an institution where skilled treatment is available.

Acute Infectious Diseases.—Most of the acute infectious diseases may occur during the course of the puerperium and may for a time at least be confused with puerperal infection, since fever is likely to be the most noticeable symptom. With the development of other signs, though, or by reason of the peculiarities of the temperature curve, it is usually possible to arrive at the correct diagnosis. The obstetrical condition ordinarily does not affect the course of the disease, which may be treated exactly as in the non-pregnant state.

CHAPTER XIX

DISEASES AND ABNORMALITIES OF THE NEWBORN

Those conditions which primarily affect the fetus while still *in utero* have been taken up in preceding chapters. The discussion of asphyxiation under Abnormal Labor may not have seemed entirely logical, but was decided upon because it so frequently furnishes the indication for operative delivery. The present chapter will be devoted chiefly to a consideration of such diseases of the newborn as occur during the period in which it may still be under obstetrical supervision.

Congenital Atelectasis.—This disease consists of the persistence of the fetal condition in certain areas of the lung tissue. Before birth the lungs contain no air, but, from the first inspiration, progressively more and more of the air cells become distended by it, so that, in the course of a few days, both lungs are completely expanded. Subsequent collapse of the lung tissue is due to some mechanical post-natal cause and consequently is not included under the designation, congenital atelectasis.

The condition commonly occurs in babies who were asphyxiated at birth or who were born prematurely, so that any factor which leads to either of those accidents may be cited as the ultimate cause of the atelectasis. In the most clear cut cases, the child is asphyxiated at birth and efforts at resuscitation are only partially successful. In those cases in which spontaneous and regular respirations may be finally established, a slight cyanosis persists, which gradually deepens, and death from asphyxiation and exhaustion occurs within a few days. In other instances, complete resuscitation may seem to have been effected, yet the child, which may appear to be healthy, never does well. Its cry is not loud and strong, it shows practically no gain in weight and presents such evidence of poor circulation as cold extremities. Some weeks later, attacks of cyanosis occur, which are followed by convulsions and, finally, by death. Atelectasis is diagnosed largely from the symptoms rather than from the physical findings.

The treatment is both prophylactic and curative. The former consists in persistent efforts to produce satisfactory breathing as evidenced by loud crying after birth. This applies to normal as well as to asphyxiated babies and explains the need for stimulating all children which do not cry loudly immediately after they come into the world. Care in this regard on the part of the physician will limit the number of cases of atelectasis, but the nurse should supplement his efforts by seeing to it that all babies have a few minutes hard crying each day during the first week or two. Sensory stimulation may be necessary, while in rare cases, the use of hot and cold tubs may be the only efficient method.

Curative treatment consists in the employment of similar measures, but with still more persistence, for the life of the infant depends upon complete expansion of the lungs. The older the child, the greater will be the difficulty of attaining this end. It is quite essential that the body heat be maintained by the use of hot water bottles or other devices. Cyanotic attacks are treated by the methods recommended for use in asphyxiation. Inhalations of oxygen are useful, but drugs in general have no effect.

Jaundice (*Icterus*).—In the majority of instances, jaundice in the newborn is a physiological phenomenon resulting from the destruction of the excess red blood cells present in the body at birth—*physiological jaundice*. A considerable proportion of all children are thus affected during the first few days of life, but the condition has no appreciable effect upon their general health. The stools lose their black, tarry appearance at the usual time and become normally yellow, while the rate of growth as shown by the weight curve is not disturbed. All grades of discoloration, from a faint yellowish tinge to an intense yellow coloration, are noted. In premature and feeble infants, the incidence is higher and the discoloration more marked. No treatment is necessary, as the jaundice disappears spontaneously within a few days and does not return.

As a symptom of a pathological process, icterus may be noted in sepsis of the newborn, as well as in conditions arising from malformations of the liver and bile ducts, or from other intra-uterine diseases such as interstitial hepatitis. The first may be diagnosed by the presence of other signs of an infectious process, and the others by the absence of bile from the stools, which, in consequence, may be white instead of bright yellow, after the meconium has been evacuated. Moreover, the jaundice becomes progressively more intense, and death usually follows, since therapeutic measures are of no avail.

Sepsis of the Newborn.—This term is commonly employed to designate the various infectious processes due to invasion by pyogenic organisms. It is essentially a wound infection, and consequently, can develop only in the presence of a definite break in the skin or mucous membrane. The most usual portal of entry for the bacteria is the umbilicus, but it may be offered by accidental abrasions on any part of the body. The offending organisms may come from the hands of the attendants or from imperfectly sterilized instruments or dressings. Localization of the process is the most favorable outcome, while the development of a true septicemia is the most serious. This latter eventuality frequently follows *omphalitis* (infection of the umbilicus), particularly when the process spreads to the occluded umbilical vessels within the abdomen. In this event the micro-organisms are disseminated by the blood stream and may set up local metastatic infections in various parts of the body, the most common locations being the peritoneal, pleural and pericardial cavities, or the meninges. The bacteria concerned are most frequently streptococci or staphylococci, but other organisms may occasionally give rise to the infection.

The diagnosis of a septicemia is often difficult, and frequently is not made except at autopsy following a fatal outcome. The symptoms generally include an irregular fever, constant and rapid wasting, poor appetite, jaundice and diarrhea appearing during the first two weeks of life. Hemorrhages may occur under the skin or from the mucous membranes. Marked nervous phenomena sometimes develop and death follows promptly.

Curative measures are so unsatisfactory that the only reasonable treatment is prophylactic. By the use of aseptic precautions in the care of the umbilical stump, as well as in the treatment of accidental wounds, practically all serious infections can be avoided. As the nurse is largely responsible for the care of these possible foci of infection, she should use the utmost diligence in keeping the healing umbilicus and other abraded areas surgically clean. Local lesions, including superficial collections of pus, are treated by the usual surgical procedures; but, when septicemia has developed, supportive measures are indicated, in the hope that the resisting mechanism of the body can successfully combat the disease. The high mortality, however, indicates the futility of our remedies.

Conjunctivitis (*Ophthalmia neonatorum*).—Conjunctivitis in the newborn, may result from the introduction of various pyogenic organisms, but the gonococcus is so generally the causative factor in the more severe cases, that the term ophthalmia neonatorum is loosely used as synonymous with gonorrheal ophthalmia. Although the most common mode of infection is from the vaginal secretion of the mother during the birth process, contamination of the eyes may occur from the hands of the attendants or from instruments and dressings.

Gonorrheal ophthalmia usually develops on the third day of life, with the appearance of a profuse purulent discharge from the eyes and marked swelling of the lids. The diagnosis is made by the microscopical detection of gonococci in the secretion, while treatment must be immediately instituted, as delay may rapidly lead to ulceration of the cornea and to the involvement of the deeper structures of the eye, with resultant permanent blindness. It has already been indicated that at least one-third of all cases of total blindness can be attributed to such infections.

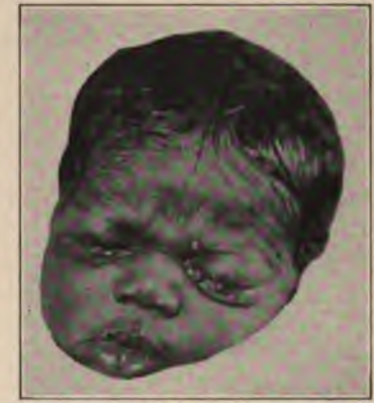


FIG. 154.—Gonorrheal ophthalmia of the newborn. Note the swollen lids and abundant creamy pus.

As has been previously emphasized (page 142), Credé's method of prophylaxis is of the utmost importance. If, in spite of this precaution, the disease does develop, prompt and energetic treatment alone can preserve the sight of the child. Cleanliness is of prime importance, and frequent irrigations with normal saline solution or with saturated boric acid solution should be continued night and day in order to keep the eyes clear of pus. In severe cases it may be necessary to repeat them every twenty or thirty minutes. Once or twice a day two drops of one per cent silver nitrate solution, twenty per cent argyrol or five per cent protargol are instilled into the affected eye or eyes following an irrigation. As gonococci are especially susceptible to the antiseptic action of the salts of silver, these consequently take precedence over all other preparations in the prophylaxis and treatment of gonorrheal infections. Cold applications over the closed lids are likewise employed. Small, square, gauze pads are cooled on a conveniently placed block of ice and are changed at frequent intervals. The use of such compresses should occasionally be discontinued for an hour or two, for fear that the continued cold may foster the production of ulcerations by interfering with the circulation in the eye. In the presence of a corneal ulcer, instillations of one per cent atropin solution are employed to produce complete dilatation of the pupil, so that the iris may not become involved.

When only one eye is involved, every effort should be made to protect the other from infection. This may be attempted by the constant application of compresses soaked in a mild antiseptic solution, such as boric acid, and the occasional instillation of argyrol or protargol, by the employment of an occlusive collodion dressing, or better by means of a watch crystal held in place by adhesive plaster with the temporal side left open for air and possible irrigation.

To prevent the spread of the disease, strict isolation must be enforced. Everything which comes in contact with the eyes must be carefully disinfected; the cotton and gauze should be burned, while the medicine droppers and irrigation apparatus should be thoroughly boiled. The nurse should be relieved of all other duties, or, if this is impossible, she should wear a gown, rubber gloves and protective goggles when giving a treatment and thoroughly disinfect her hands before caring for other patients. In this connection, she must remember that her own eyes are susceptible to infection, and that she must exercise the greatest care to avoid contamination from her hands or from splattering droplets of the irrigating fluid. This danger is a very real one and every physician of experience can recall instances in which nurses have developed severe gonorrheal ophthalmia and sometimes have lost the sight of one or both eyes.

The *Simple Ophthalmias* resulting from infection with other pyogenic organisms do not ordinarily appear until the latter part of the first week of life and usually give rise to less severe reactions. As bacteriological examination furnishes the only reliable means of diagnosis, a smear should always be made and examined, whenever pus appears in a baby's eye. Boric acid irrigations and instillations of argyrol or protargol usually control the process, but in protracted cases it may be necessary to employ one-half per cent zinc sulphate solution to effect a cure. Isolation is important, even though the disease is much less serious than gonorrheal ophthalmia.

Hemorrhage.—Hemorrhages among the newborn are by no means rare, and are sometimes fatal. They may occur in association with sepsis or syphilis, but not uncommonly there is no detectable accompanying disease. There are two distinct groups: (1) *traumatic* or *accidental hemorrhage* due to accidents occurring during or after labor; and (2) *spontaneous* or *idiopathic hemorrhage*, the etiology of which is as yet unknown.

Traumatic Hemorrhages usually result from artificial delivery, but may follow an easy spontaneous birth.

Cephalhematoma.—This is a tumor formed by the extravasation of blood beneath the periosteum covering one of the cranial bones, in consequence of the rupture of a small blood vessel in that membrane. It forms a fluctuant mass which is definitely confined to the limits of one bone and never passes over a suture or fontanelle. When two or more hematomata are present they form separate tumors which do not fuse. The cephalhematoma is usually situated over one of the parietal bones, but occasionally the occipital bone is involved. The condition is observed once or twice in every one hundred infants, and is by no means indicative of violence, as it sometimes follows easy spontaneous labor.

The swelling is usually noticed during the first days after birth and gradually increases in size, reaching its maximum by the end of a week. In the early stages, the blood is fluid and the tumor elastic and fluctuant, but, later, an outer rim of bony tissue develops at its periphery, from which the rest of the capsule becomes ossified, with the result that a crackling sensation is obtained on pressure. The blood is slowly absorbed and the calcified capsule becomes adherent to the underlying skull, so that within two or three months the head has regained its normal contour.

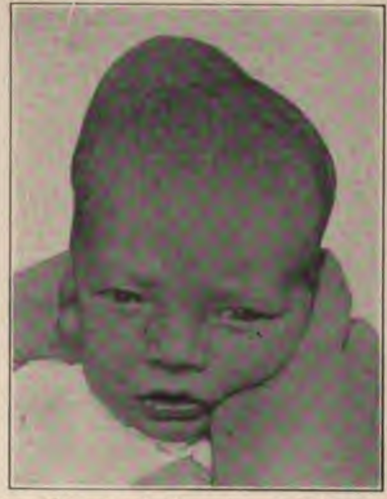


FIG. 155.—Cephalhematoma of the right parietal bone.

No treatment is required, unless the contents become infected, when surgical incision and drainage are indicated.

Hematoma of the Sternomastoid Muscle.—Hematomata of the sternomastoid muscle are more particularly seen following breech extractions. They appear as small, movable, hard tumors on one side of the neck in the position of the muscle, and result from the tearing of small blood vessels in its substance. Absorption of the blood proceeds slowly, and no treatment is required.

Visceral Hemorrhages.—Hemorrhage may occur into the abdominal or thoracic viscera in consequence of trauma sustained during birth. The danger is greater in difficult breech cases, but at times damage may result from the employment of too vigorous methods of resuscitation. The prognosis depends upon the position and size of the hemorrhage. Diagnosis is extremely difficult, and treatment is expectant.

Intracranial Hemorrhages.—Intracranial hemorrhages are more frequent following prolonged labors, and especially difficult operative deliveries. They may, or may not, be associated with fracture of the skull. The clinical picture varies with the size and location of the hemorrhage; small extravasations over the so-called silent areas of the brain producing no symptoms, while large collections of blood near the base of the skull are rapidly fatal. In the intermediate cases, the child is usually asphyxiated at birth, and, even after respiration has been established, breathing is irregular, and the child seems dull and feeble. Muscular rigidity and increased reflexes may be present and convulsions frequently occur. Paralysis may develop if the lesion is localized. The fontanelles are bulging and the pulse is slowed. On lumbar puncture the spinal fluid will usually be blood-tinged.

The treatment is operative, and offers a fair chance of success, if localizing symptoms indicate where the skull should be opened. In this event, if the clot and torn vessel are found, the former is removed and the latter ligated.

Umbilical Hemorrhage.—Umbilical hemorrhage resulting from the loosening of the ligature is occasionally seen. A second ligation will promptly control the bleeding. The occurrence of any other loss of blood from the cord during the first few days of life is of considerable significance, because of its frequent association with hemorrhagic disease of the newborn or with syphilis.

Spontaneous Hemorrhages.—Spontaneous bleeding into the skin or from the various mucous membranes (hemorrhagic disease of the newborn) is relatively common, and occurs in one to two per cent of newborn children. It may be associated with sepsis or syphilis, but in most instances no definite etiological factor can be elicited, although it seems probable that some of the factors participating in the normal coagulation of the blood are at fault. The disease is in no way associated with hemophilia, which ordinarily does not appear until after the end of the first year of life, and then, only in boys. Furthermore, no evidence has been adduced that it is due to hereditary tendencies. In these cases, within the first week, hemorrhagic areas are noted under the skin, blood is passed from the mouth or rectum, or there is a hemorrhage from the umbilicus. When the hemorrhage occurs into the digestive tract, large tar-colored or blood-stained stools are passed, and the condition is designated as *melena neonatorum*. The first hemorrhage is rarely fatal, but unless measures are adopted to prevent the further loss of blood, the child will become exhausted and rapidly die.

Formerly, the mortality was about 80 per cent, but the newer treatment, which consists in the injection of normal blood into the baby, has reduced it to 5 or 10 per cent. The procedure consists in aspirating 25 to 50 cubic centimeters of blood from the arm vein of a healthy person, preferably the mother, and injecting it immediately under the skin of the baby between the shoulders, and repeating it within a few hours if bleeding continues. Human or horse serum may also be used, but possesses no particular advantage. When the child's condition is particularly serious, the blood may be introduced directly into its circulation through the external jugular vein or the superior longitudinal sinus of the head.

Birth Paralyses.—Paralyses of various muscles sometimes follow delivery and, according to the location of the causative lesion, are divided into two main types—central and peripheral.

Paralyses of Central Origin are produced by intracranial hemorrhages and vary according to the location and extent of the blood clot. Thus, the entire side of the body may be involved—*hemiplegia*—or only the face, arm or leg—*monoplegia*. More frequently there is a spastic paraplegia—*Little's disease*—in which the effused blood collects between the two hemispheres of the brain over the centers supplying the legs. In this event, subsequent degeneration of the tissues leads to the formation of small cystic areas which damage the motor cells beyond hope of repair. The prodromal symptoms in these cases are those described under hemorrhage. Treatment consists in removal of the clot after its location has been determined by existing signs, or, if that is inadvisable, in the education of the child to diminish as much as possible the effects of the paralysis.

The *peripheral* palsies most frequently seen in the newborn are facial and brachial.

Facial Paralysis may be of central origin, but, ordinarily, when unassociated with paralysis of other parts, it is due to local injury of the facial nerve at its point of emergence from the skull. The lesion may follow spontaneous labor, but is most common after forceps delivery. If the blades are applied somewhat obliquely to the head, one of them may so damage the nerve by pressure that its fibers cannot transmit impulses from the higher centers, and complete paralysis of the muscles supplied by it inevitably results. In consequence of the paralysis of the lid muscles, the eye on the affected side remains constantly open, and, when an attempt is made to distort the face, as in crying, the paralyzed side remains immobile, while the relaxed tissues are drawn toward the unaffected side. The tongue is not involved, and nursing is not interfered with.

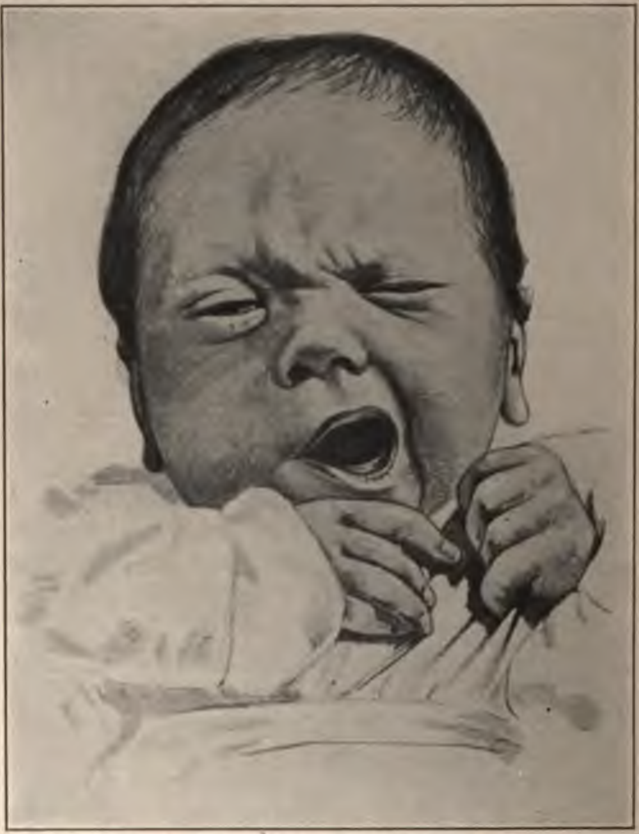


FIG. 156.—Facial paralysis. (Berkeley and Bonney.)

The symptoms appear within a few hours after birth and are not progressive. Fortunately, they almost invariably gradually improve spontaneously, so that within a few months no sign of paralysis remains. Treatment is limited to preventing infection of the eye from dust and injury by occasional irrigations with saturated boric acid solution. In severe cases recovery is more delayed and recourse may be had to electrical stimulation.

Brachial Paralyses are not uncommon as a result of birth injuries to the nerves supplying the arm muscles. They usually follow breech extractions in which the arms have been extended over the head, or vertex presentations, when considerable difficulty has been experienced in the delivery of the shoulders. In such cases, by reason of the unusual tension placed upon the nerve trunks constituting the brachial plexus, certain of the fibers rupture and bleeding occurs within the nerve sheath. Usually the paralysis becomes apparent within a few days, and the affected arm hangs limply by the side with the palm rotated outward—*Erb or Duchenne Paralysis.* The paralyzed muscles vary according to which nerve trunks have been injured, but more commonly the upper arm is affected, while the forearm and hand are not involved.

In many instances spontaneous and complete cure results within one or two months. At first only postural treatment is required; the arm being held in the position indicated in Fig. 157 by means of a safety pin or light sand bags. This does not interfere with spontaneous recovery, and has the additional merit that it insures the most useful position for the arm, should the paralysis persist permanently. When definite improvement is not noticeable at the end of a month, massage and electrical stimulation should be instituted. If the paralysis resists all other treatment, operative suturing of the torn nerves is sometimes productive of excellent results. It should, however, be regarded only as a last resort.

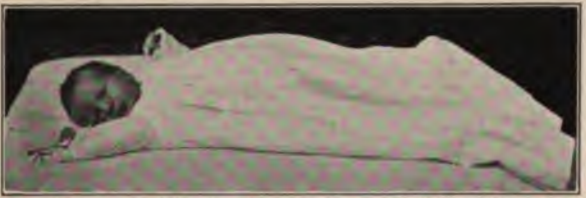


FIG. 157.—Proper position for the arm in cases of brachial paralysis.

Fractures and Dislocations.—Difficult operative deliveries, more particularly versions and breech extractions, may result in the fracture of bones or the dislocation of joints. Such injuries may easily be overlooked for some time, unless the children are very closely observed, and a tendency to favor a single limb directs attention to their existence. The clavicle, humerus or femur is most frequently fractured, while the shoulder joint is most likely to become dislocated. Absolute diagnoses can be made by means of the X-ray.

Manual reduction should be performed as soon as the diagnosis is made, and a proper splint or crinolin bandage applied and kept in position for some weeks.

Fracture of the skull was considered in an earlier section.

Umbilical Hernia.—Protrusion of part of the contents of the abdomen into the umbilical cord is a very serious, but fortunately rare, complication, and can only be relieved by a radical surgical operation.

The common umbilical hernia due to a weakness of the umbilical ring does not produce symptoms unless it is unusually large. Many cases undergo spontaneous cure, but certain mechanical procedures are advocated to promote healing. The simplest and most efficient consists in the use of half-inch strips of adhesive plaster. After one end has been fastened securely to the skin over one flank, the hernial contents replaced and the skin over the umbilical ring folded up to form a tissue pad, the adhesive is pulled tightly over to the other flank and secured to the skin. By this means the median fold of tissue is utilized to prevent the abdominal contents from distending the hernial ring, while its closure is facilitated by the approximation of the edges of the recti muscles. More commonly, a roll of gauze or a large padded button is placed over the opening and retained in position by adhesive plaster, and is ordinarily quite efficacious. As these latter devices occasionally lead to increased dilatation of the ring, their use is being slowly discarded. When adhesive is employed, it is quite essential that it be changed every week or two and that care be taken to prevent excoriation of the skin. The treatment must be continued until the ring is well closed, which will often take several months, though in extreme cases surgical closure may be necessary. Trusses have no place in the treatment of the condition.

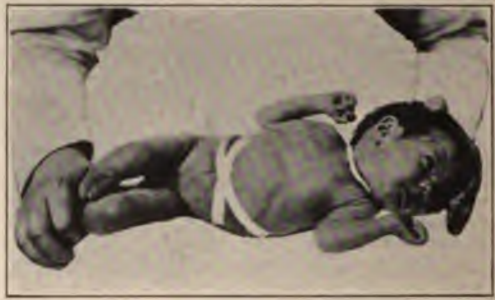


Fig. 158.—Method of strapping an umbilical hernia.

Umbilical Granulomata.—Frequently, after the umbilical cord has separated, the granulation tissue in the healing stump grows at an excessive rate and forms a small red mass which bleeds readily, and discharges a thin, purulent secretion. Such tumors are known as *Umbilical Granulomata,* and are best treated by cauterization with silver nitrate and a dry gauze dressing held in place by adhesive plaster. If exceptionally large, some of the tissue may be cut away with scissors before the "lunar caustic" is applied.

Mastitis.—The swelling of the breasts of infants of either sex, which frequently occurs during the first few days of life, has already been mentioned. Occasionally, a true infectious process may develop in the functioning glands due to the invasion by micro-organisms. The latter, which are almost invariably present in the terminal ends of the milk ducts, ordinarily do no harm, but when the resistance of the breast tissue is diminished as the result of congestion, they find suitable conditions for multiplication and invasion. Less frequently, slight abrasions of the skin probably provide a portal of entry, while rough handling by the attendant or undue pressure by bandages may act as contributory causes.

The symptoms usually appear early in the second week, and consist in the characteristic signs of inflammation, associated with fever, restlessness and loss of weight.

Cleanliness is most important, while hot or cold applications or ichthyol ointment may be used in an attempt to prevent the formation of pus. *Massage,* on the other hand, *is absolutely contra-indicated.* If pus develops, prompt incision and drainage is required, when an opening, radiating from the nipple, should be made in the lower half of the breast, so as to reduce the disfigurement to a minimum.

Thrush.—Thrush is a parasitic disease characterized by the development of white patches upon the mucous membrane of the mouth, which are not easily wiped off, and which, if forcibly removed, leave small raw areas. The organism is a vegetable fungus, *oidium albicans,* which does not grow upon the intact surface, and can only flourish if slight abrasions are present. The disease is distinctly infectious and mild epidemics are very common in large nurseries. Lack of proper cleanliness, as well as the practice of wiping out the mouth with gauze are the chief etiological factors concerned, and with their elimination the disease rarely occurs. An abundant flow of saliva interferes with the growth of the fungus; accordingly infants under three months are most commonly affected because of the scanty secretion at that time. Microscopical demonstration of the fungus clears up the diagnosis. The disease is rarely serious, except when associated with prematurity, cleft palate or harelip.

Isolation is essential if the spread of the infection is to be avoided, consequently the affected child should have a special bassinet and great care should be taken to disinfect all nipples and swabs which have entered its mouth. Cleanliness is the most important feature in the treatment, and the majority of cases will clear up within a few days without the employment of special remedies. When active measures are indicated, a 3 or 5 per cent solution of sodium bicarbonate should be applied by means of a toothpick swab after each feeding, or a 1 per cent solution of formalin may be used twice daily. Injury of the buccal mucous membrane is to be avoided during the manipulations.

Napkin Rash.—Napkin rash is a form of intertrigo appearing between the thighs, upon the buttocks or about the genitalia. It is due to excessive moisture and lack of cleanliness, resulting from neglect to change soiled diapers promptly. The lesions may vary from a simple reddening of the skin to actual ulceration associated with destruction of the superficial layers of the skin. Premature babies are more prone to the disease than mature children, and in them it is more difficult to effect a cure.

Prophylactic measures are most important, and the value of dryness and cleanliness cannot be over-emphasized, especially in small and feeble infants. As an additional precaution, it is wise to leave the diaper off for a few minutes once or twice daily so that the parts may be well aired. At the first indication of the disease, bathing of the child should be discontinued and the body should be cleansed by oil or alboline. After each urination and defecation, the affected area should be gently dried with a soft cloth, and stearate of zinc or corn starch sprinkled over it before the clean diaper is applied. In more stubborn cases, starch paste or Lassar's paste should be employed instead. Such treatment will quickly relieve the condition in healthy children, but in premature infants it is a more serious problem.

Congenital Heart Disease.—Congenital heart disease is a relatively rare condition which is commonly associated with other anomalies of development. The most usual lesions are imperfect closure of the auricular or ventricular septum, or stenosis of the pulmonary artery. Clinically, cyanosis is the most striking sign, and children thus affected are known as "blue babies." In the more severe cases, death occurs during the first days of life, but frequently the lesion is so slight that, under carefully guarded conditions, the child may reach maturity. No treatment can relieve the underlying condition, but individual symptoms should be combated as they arise.

Inanition or Dehydration Fever.—This term is used to designate the elevations of temperature observed in children during the first weeks of life as a result of insufficient nutriment. Equally characteristic is the prompt fall to normal when food or even an abundance of water is given. The condition is observed in ten to twenty per cent of newborn children, usually appearing on the second to fourth day. The temperature rises rapidly to 101°, to 102° F. (38.4° to 38.9° C.), and, occasionally, may reach 106° F. (41.1° C.). The child is restless, its skin is hot and dry, and it vigorously sucks anything within reach. There is a rapid and excessive loss of weight, which continues until the temperature has fallen to normal. There is no evidence of other disease, but examination of the breasts of the mother or systematic weighing of the child before and after feedings will show that practically no milk is being obtained, so that, if the condition is not recognized, the child may die from starvation.

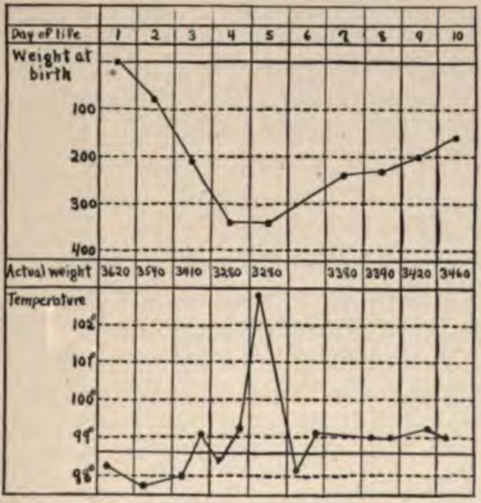


FIG. 159.—Chart showing weight and temperature curves in a case of inanition fever.

The treatment consists in the institution of artificial feeding with pumped breast milk or with a cow's milk formula, and the free administration of water every two or three hours. Ordinarily, the temperature falls within twenty-four hours after the ingestion of suitable food, and does not rise again. The child at once begins to gain in weight and within a few days shows the normal daily increase.

Vomiting.—Vomiting in young infants may be due to several causes: too much food, too rapid eating, too rich a formula, or an excessive amount of air and gas in the stomach. Persistent vomiting of all ingested fluid should suggest an obstruction in the gastro-intestinal tract, and if it follows every attempt to swallow even very small quantities, the possible existence of stenosis .of the esophagus should be considered.

When due to dietary errors, cure can be affected by the removal of the cause. The ingestion of too much food in breast-fed babies can be determined only by systematic weighings before and after feedings, and can be corrected by reducing the duration of each nursing until only a sufficient amount is obtained. Too rapid feeding is seen in bottle-fed babies and may be overcome by using nipples with smaller holes. Excessive fat in the milk can be avoided by diminishing the quantity of milk in the formula. Employment of the maneuver previously recommended for facilitating the expulsion of gas from the stomach after feedings will usually effect a cure, when the vomiting is due to swallowed air. When an obstruction or stenosis is the etiological factor, the condition can only be remedied by surgical procedures, if at all.

Hiccoughs.—Hiccoughs most commonly result from too little food, but may be due to too much food or to the unsuitable constitution of the milk. The first factor should be determined by weighing before and after meals, and the others should be considered only after it has been shown that the diet is sufficient. The proper regulation of feeding will ordinarily relieve the condition.

Convulsions.—The nervous mechanism of infants is very unstable, and, consequently, a great variety of conditions may lead to convulsive attacks. In the first week of life they are most frequently associated with cerebral hemorrhage, asphyxiation or atelectasis. They are sometimes observed in children born of eclamptic mothers, but in many others the etiology is not clear. Later in infancy, tetany associated with rickets, nutritional disturbances, acute infections and cerebral diseases, are the most important etiological factors. The attacks frequently come on without warning; the eyes become fixed and muscular twitchings begin in the face or in one extremity and rapidly spread to the entire body. There is frothing at the mouth, cyanosis and a gurgling noise from the larynx, and a period of unconsciousness and prostration follows the convulsion. Death during the attack is rare, but is more likely in newborn than in older children. When it does occur it is due to asphyxiation.

Logical treatment necessitates a correct diagnosis, because the measures to be employed vary with the causative factor. Thus, when due to intracranial homorrhage, operative measures alone can effect a cure, while the treatment outlined in the discussion of asphyxia is useful when the symptom is associated with poor aeration of the lungs. In the so-called "eclamptic convulsions" of the newborn, quiet must be secured, the body kept particularly warm, and the child made to drink as much water as possible. Spinal puncture, by relieving the intracranial pressure, may be useful.

In older children, chloroform, chloral or morphin are employed to control the attacks, but scarcely have a place in the treatment of the newborn.

When convulsions occur the nurse should immediately notify the physician, but while awaiting his arrival, she should keep the child as quiet as possible and should assure herself that it is sufficiently warm. Moreover, she may give sodium or potassium bromide, 10 grains (0.60 gram) by mouth, dissolved in a little water, and may place the child in a mustard bath or pack. Such procedures aim at the control of the immediate attack, whereas subsequent treatment must be based upon the etiological factor, and can only be directed by the doctor.

Sleeplessness.—Sleeplessness or disturbed sleep in very young infants is ordinarily due to hunger or to colic. The former should first be considered and the amount of food obtained at each nursing accurately determined by before and after-meal weighings for a few days. If due to insufficient food, the institution of supplementary feedings will soon be followed by normal intervals of sleep. If due to colic, the cause will become apparent from the characteristic symptoms and relief will follow the institution of proper treatment.

Colic.—Intestinal spasm giving rise to severe abdominal pain is known as *colic*. Flatulence and constipation are commonly associated symptoms, with digestive disturbances as the underlying factor. Chilling of the body may be the exciting cause. The child is fretful and restless, with recurring intervals of violent crying, during which the arms and legs are drawn up to the body. The abdomen is tense and tympanitic.

Flatulence may be relieved by an enema of warm water, or of water and glycerine, while hot applications to the abdomen are sometimes useful. Changing the child's position facilitates the passage of the intestinal gas and relief is sometimes obtained by placing the child face down over the knee for a few minutes. Attention to the expulsion of stomach gas following each feeding is a reasonable prophylactic measure. In some babies, the practice of sucking an empty bottle or a hollow pacifier seems to give rise to colic and should not be permitted. Young children should always be warmly clothed and extra coverings should be added with any considerable change in the temperature. Permanent cure can, however, not be expected, until the underlying digestive disturbances are corrected.

Phimosis.—Phimosis is a condition in which the opening in the prepuce of the penis is narrowed to such an extent that it cannot be retracted over the glans. In this event, cleanliness is impossible, and the presence of dried secretions may give rise to sufficient irritation to produce nervous symptoms or to interfere with urination. The importance of early retraction of the foreskin has already been emphasized, and it was stated that the existence of a phimosis necessitates circumcision. This is best performed during the second week.

Syphilis.—The treponemata pallida, the causative organisms of syphilis, may be transmitted to the child *in utero* from either the mother or the father. In a previous chapter this infection was mentioned as the most frequent cause of intra-uterine death during the last third of pregnancy, and its lesions were briefly described. The term *hereditary syphilis* is employed to designate the ante-natal origin of the infection. Acquired syphilis occurs so very rarely in young infants that it does not call for consideration.

Occasionally, when the syphilitic child has been born alive, it may present definite and characteristic lesions, but more commonly these do not appear until a few weeks later. In the former group the infection is usually so severe that death ensues within a few days, while in the latter and more frequent group the children appear quite normal at birth, but within two to six weeks various characteristic symptoms make their appearance. *Snuffles,* a condition resembling "a cold in the head" may be the first symptom, and consists in a profuse serous discharge from the nose, which, after drying, forms crusts and flakes in the nostrils, and sometimes gives rise to definite superficial ulcers. In the more severe infections, serum-filled vesicles may appear in the skin, especially on the palms of the hands and the soles of the feet—*Pemphigus.* A later form of skin eruption consists of round, red macules, which gradually fade to a copper color. Mucous patches may develop in the mouth and around the anal region, and deep fissures may appear at the angles of the mouth, as well as upon the flexor surfaces of the joints. There may be marked tenderness at the ends of the long bones and the general poor health may be indicated by a progressive cachexia.

The diagnosis is made from the clinical picture and is confirmed by the laboratory findings. The causative treponemata pallida can frequently be demonstrated in the superficial lesions, while examination of the placenta may reveal the characteristic changes. Moreover, X-ray examination of the long bones may show the characteristic osseous changes due to syphilis. During the first three months of life, the blood Wassermann reaction does not give reliable information, as it may be negative even though the child has syphilis, but it later becomes positive.

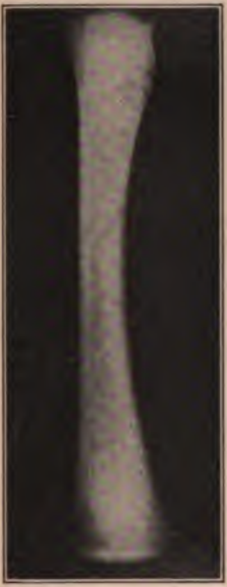


Fig. 160.—X-ray photograph of normal bone.

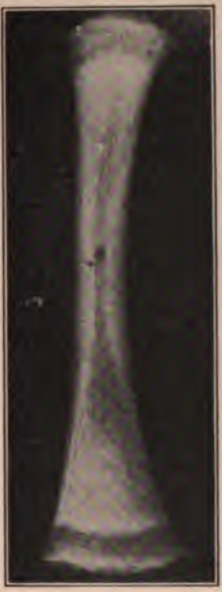


Fig. 161.—X-ray photograph of syphilitic bone.

Without treatment most syphilitic children die within a few months, either from the disease itself, or from an intercurrent infection.

The only efficient treatment is prophylactic in nature and consists in the persistent use of the usual syphilitic remedies in every pregnant woman who is known to have the disease. In this way the birth of syphilitic children can be in great part prevented and hereditary syphilis reduced to a minimum. When, because of the absence or insufficient character of ante-natal treatment, the disease appears in a newborn child, every effort should be made to stop its ravages. At present the recognized procedure is the repeated intravenous injection of small doses of one of the newer arsenical preparations into the external jugular vein or the superior longitudinal sinus, although at times the drug, suspended in a bland oil, is injected deeply into the muscles of the thigh. After several such treatments at intervals of a week or two, recourse is had to inunctions of mercurial ointment and the oral administration of potassium iodid.

Tonic remedies are most useful, and it is sometimes advisable to stop all specific treatment for a time, and to administer cod-liver oil and iron, to overcome the tendency toward anemia and malnutrition. It is doubtful whether hereditary syphilis can ever be completely cured, but the measures here advocated can be relied upon to relieve the more outspoken symptoms and to hold the treponemata in abeyance. After the Wassermann reaction has been negative for some time, treatment may be discontinued, but the blood should be re-examined at intervals of three to six months, and, if the reaction again becomes positive, a new course of medication should be begun.

Prematurity.—Although the full term of pregnancy is ten lunar months, children who have remained *in utero* for nine months are usually well equipped for a separate existence and are regarded as *mature*, while those born between the twenty-eighth and thirty-sixth week are designated as *premature*. The latter, weighing less than 2500 grams ($5^1/_2$ pounds) and measuring less than 45.0 centimeters (18 inches) present special problems. The smaller and more delicate the child, the greater is the need for care and the less the chance that it can be raised, which is due to the fact that its organs are imperfectly developed and are not prepared for the work demanded by extra-uterine conditions.

The three essentials in the care of premature infants are: (1) the maintenance of body heat, (2) proper nourishment, and (3) the prevention of infection.

The maintenance of body heat by artificial means is necessary because the heat production is deficient, as well as because the relatively greater surface area per unit of weight favors excessive heat radiation. In large institutions, specially constructed rooms are maintained at a constant temperature of 90° F., or electrically controlled incubators are employed with accommodations for one or more babies. When such means are not available, satisfactory results may be obtained by the use of a deep clothes basket, bassinet or a suitable box warmed by hot water bottles or by an electric pad, and kept in a warm room protected from drafts.

If the child weighs less than 1800 grams (4 pounds) it should be wrapped in absorbent cotton after an oil rub. The cotton is kept in position by a light blanket, while a pad of gauze and cotton replaces the usual diaper. Handling must be reduced to the minimum, although the napkins should be changed when necessary, but the child is fed without removing it from its bed. Every two or three days the wrappings are removed, and the body rubbed gently with oil before the new ones are applied. The child's position should be changed every few hours, and a certain amount of active movement encouraged by loosening the coverings over its arms and legs. The rectal temperature should be taken every few hours to ascertain whether the necessary external heat is being applied, as well as to guard against overheating by defective electrical devices or too hot water bottles. A rectal temperature of 98° to 100° F. indicates that extremes are being avoided.

Feeding.—As premature infants are generally too weak to suckle, even if the necessary handling and possible chilling did not contra-indicate it, they must be fed by means of a medicine dropper or a Boston feeder; while, in very feeble infants, gavage may be necessary. Cow's milk mixtures are generally unsatisfactory, and consequently, breast milk from the mother or a wet nurse, should be used, whenever possible. At first it should be diluted with an equal quantity of five per cent sugar solution and given slowly in half ounce portions every three or four hours, the dilution being diminished and the amount increased as the child grows and gains strength. In addition, small quantities of water or sugar solution should be given two or three times during the twenty-four hours. It is advisable to begin feeding during the first day, in the hope of diminishing the usual initial loss of weight.

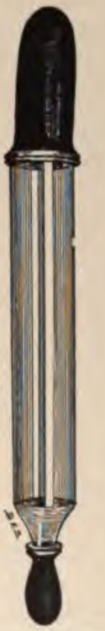


FIG. 162.—Boston feeder for premature infants. (½ natural size.)

Protection against infection is afforded by isolation and by careful attention to the cleanliness of the dressings and feeding apparatus. As premature infants offer but slight resistance to bacterial invasion, they often succumb to an apparently trifling infectious process. Consequently, visitors should not be allowed, and even the mother should see the baby only once or twice a day. As such children are especially susceptible to respiratory infections, no one with even a slight cold in the head should be allowed to approach them.

THERAPEUTIC MEASURES DURING EARLY INFANCY

Stimulating Tub Baths.—When stimulation is needed, as in asphyxiation and congenital atelectasis, alternate hot and cold tubs are employed. The former should be at 100° to 105° F., while the latter should be chilled by pieces of ice. After placing cotton in the ears to prevent the entrance of water, the child is immersed in the hot tub until thoroughly warm, and then dipped mometarily in the cold tub, the process being repeated until it has cried satisfactorily. It is then wrapped warmly in blankets and placed in a bassinet with hot water bottles. If the umbilicus has not healed, the old dressing should be left in place until after the tubbing and then replaced by a new sponge saturated with 95 per cent alcohol.

Eye Irrigations.—The soft rubber bulb syringe to be used is thoroughly sterilized by boiling, and the sterile solution to be used is placed in a suitable container. The child is wrapped in a blanket to prevent movement of the extremities and a curved dressing basin is placed under the head, which is held in one hand, while the irrigation is conducted with the other. The fingers of the first hand can be used to open the lids of the eye. If another person is available, it is much more convenient to have one attend to holding the child, while the other conducts the irrigation. A rubber sheet and a towel are employed to protect the surroundings. The irrigation fluid is introduced gently into the inner angle of the eye and allowed to run into the basin. If the gonococcus is the organism concerned, it is much safer if the attendants protect themselves with rubber gloves, a gown and goggles before proceeding to the irrigation.

The Mustard Pack.—Place two teaspoonfuls of mustard in a gauze bag and immerse it in one quart of hot water (105° F.). Dip a large towel in the water and while still wet apply it closely about the child's body, leaving it in place for fifteen minutes, or until the skin becomes slightly reddened. Then dry the child carefully, and wrap in a warm blanket for another hour before dressing.

Enemata. In giving enemata to a newborn child, it should be held upon the lap or placed upon the nursery table. A rubber sheet and towel are placed beneath the buttocks and the legs are held as in taking the temperature. The soft rubber ear syringe which is used for the injection is filled with not more than 90 cubic centimeters (3 ounces) of warm water or soap suds and its pointed tip is introduced well into the rectum, when pressure upon the bulb will force the fluid slowly into the bowel. Unless the treatment is immediately effective, double diapers are applied and the child returned to its bassinet.

Gavage.—After the child has been wrapped in a blanket and rubber and cloth bibs have been put in place, the end of the gavage tube is moistened with glycerine and passed down the throat, when the escape of a small bubble of gas will indicate that it has entered the stomach. On the other hand, if intermittent bubbles escape, it is assumed that the tube has passed down the trachea, when it must be removed and another attempt made. When satisfied that the tube is in the stomach, turn the face of the child to one side over a curved basin and slowly pour into the funnel the feeding which has been kept warm by immersion in warm water. If there is a tendency to vomit, the chin should be elevated.

Gavage should be employed only when the child is absolutely unable to take its food any other way. Consequently, it is most frequently employed in the care of premature infants, which cannot swallow satisfactorily, even when the food is given by means of a medicine dropper.

Mercurial Inunctions.—The prescribed amount of "blue ointment," or other mercurial preparation, is slowly rubbed into the skin of the abdomen and back, five or ten minutes being consumed in the process. The binder is then reapplied and the ointment is slowly absorbed, the excess being removed at the next regular oil rub.

Drug Administration.—Drugs as such have a very small place in the treatment of the diseases occurring in infants. Liquid medicines are readily swallowed by most babies if introduced far enough back in the mouth and slowly given. Solid remedies should always be dissolved or suspended in water before administration, although calomel is most easily given by pulverizing the tablet and placing the powder far back upon the tongue.

CHAPTER XX

OBSTETRICAL DIETETICS

As the directions concerning the diet given in the preceding chapters have been very general in character, more detailed information as to the dietary requirements of the obstetrical patient may be desirable. Recent advances in our knowledge of nutrition have introduced various new factors, and nowhere in medicine does their logical application seem more likely to prove of value than in pregnant and lactating women and in infants.

Any consideration of diets is incomplete without some reference to the usual foodstuffs and their recognized dietary value, and while there can be no doubt that proteins and the other fundamental foodstuffs are essential to the preservation and well-being of the body, it has only recently been recognized that their proper utilization depends largely upon the presence of certain accessory factors, which were hitherto ignored.

The Foodstuffs.—A *foodstuff* is defined as "a material capable of being added to the body's substance, or one which when absorbed into the blood stream will prevent or reduce the wasting of a necessary constituent of the organism" (Lusk).

The foodstuffs arranged in the order of their quantitative importance are:

1. Water.
2. Carbohydrates.
3. Proteins.
4. Fats.
5. Inorganic salts.
6. Accessory factors or vitamins.

A satisfactory diet must contain a mixture of these six foodstuffs in such proportion as to maintain the organism in a state of efficiency or to induce the normal rate of growth during the period of development. Consequently, it will be necessary to say a few words about each of them.

Water.—Since water plays such an important rôle in all the life processes, the organism cannot long survive if deprived of it. Adult individuals require three to five quarts daily, but can exist upon a much smaller ration. Perhaps half of this quantity is taken with the solid foods, most of which have a high water content, while the balance is ingested in liquid form.

Carbohydrates.—The carbohydrates are organic compounds containing only carbon, hydrogen and oxygen. They are present in all plant and animal tissues, and are represented by the common sugars and starches in the former, and by glycogen in the latter. In the human economy these substances serve chiefly to furnish energy, thereby sparing the more essential proteins, and it has been demonstrated that an excess of ingested carbohydrates above the energy demands of the body may be stored as animal starch (glycogen), or may be converted into fat and deposited in the tissues.

Proteins.—Certain organic compounds consisting of nitrogen, carbon, hydrogen, oxygen and sulphur, with occasionally a trace of phosphorus or other elements, and occurring in the animal and vegetable kingdoms, are called *proteins*. Animal cells contain large amounts of these materials, whereas plant tissues contain much less and generally have an excess of carbohydrate substances. The solid portions of egg-white and lean meat are composed almost entirely of protein, and may serve as examples of this class of foodstuffs. Normal wear and tear of the body results in the disintegration of the protein constituents of its cells, and demands the ingestion of protein materials to replace their loss. In general, either plant or animal protein may supply the necessary building stones, but other foodstuffs are valueless in this respect. When excessive amounts are ingested, certain parts of the protein molecule may be changed into carbohydrates and burned as such. This, however, is a very uneconomical source of energy, partly on account of the higher cost of protein material, but principally because the carbohydrates are utilized directly, while the proteins must undergo extensive chemical transformation before they can be utilized as a source of energy.

Fats.—The fats are compounds of certain fatty acids in combination with glycerin. They are widely distributed in the plant and animal world and form an essential part of all cells, as well as serving as immense stores of energy. The body utilizes the fat of the food to supply energy or stores it in reserve. It should be regarded as a protein-sparer in the sense that a sufficient supply of fat in the diet will render it unnecessary for the organism to burn its protein for energy. When actual tissue growth is occurring, a generous supply of fat seems to facilitate the process.

Inorganic Materials.—Various inorganic substances are absolutely essential to the organism and a satisfactory diet must include a liberal allowance of them. Those most prominent in the animal economy are iron, calcium, magnesium, sodium, potassium and chlorine. Fortunately, the usual adult diet contains these elements in abundance, but during pregnancy and lactation the need for certain of them is multiplied, and consequently care must be taken that sufficient quantities are supplied. Particularly is this true with regard to calcium, which is needed for fetal bone growth, especially during the second half of pregnancy. By a curious provision of nature, the demands of the fetus will be supplied at the expense of the mother, so that her tissues will become impoverished in this respect; consequently she must be safeguarded against such a possibility by the inclusion of rather large quantities of the various salts in her food. Cow's milk is especially rich in such elements and should therefore constitute a regular addition to the day's menu.

The Accessory Factors or Vitamins.—Certain substances of unknown composition, which are essential to the normal growth and maintenance of the body, are known as *Accessory Factors* or *Vitamins.* A pronounced deficiency of these substances will result in definite diseases, whereas a partial deprivation may be responsible for various indefinite symptoms and lead to a general lowering of mental and physical efficiency. Thus far three different types of vitamins have been differentiated by their effects upon the organism.

In the present state of our knowledge, it seems probable that human beings are not able to form any of these factors within the body, but must depend for their supply through the diet. As the actual substances have not yet been isolated, they are designated tentatively as (1) Fat-soluble A, (2) Water-soluble B, and (3) Water-soluble C, each of which has its own special sphere of usefulness.

Fat-soluble A, like the others, is essential for growth and maintenance, and, therefore, is of great importance in all diets, but especially in those for pregnant women. It is found particularly in cream, butter, egg yolk and cod-liver oil, but is present in limited quantities in fresh meat, green vegetables and in whole grains. The vegetable oils, however, contain no appreciable amounts of it and it is likewise lacking in degerminated cereal products, such as white flour, cornmeal and rice. In rats a total deficiency in this factor produces an inflammation of the eyes which may lead to blindness. This can be promptly cured if the dietary insufficiency is corrected in time. Few such manifestations have been observed in human beings, but it has been suggested that "night blindness" may be attributable to a diet partially deficient in this factor. Moreover, considerable evidence is being accumulated to show that a similar deficiency is at least partly responsible for the production of rickets in infants, for this disease can be produced experimentally by feeding a diet low in calcium along with a diminished intake of fat-soluble A.

Water-soluble B is equally important for the growth and maintenance of the body, and its lack has been conclusively demonstrated as the cause of a definite human disease characterized by severe neuritis—Beri-beri. This malady occurs frequently in Oriental countries where rice is the chief article of diet. Whole rice constitutes a satisfactory diet, while polished rice does not. This is due to the fact, as has been shown, that, in the process of polishing, the vitamin-containing portions of the grain—the germ and the hull—are removed, so that when the diet consists exclusively of polished rice, a true deficiency disease results, which can be readily cured by the administration of the lacking accessory substance. The factor is therefore commonly called the *antineuritic substance.* Water-soluble B is especially found in yeast, eggs, green vegetables and whole cereals, but is lacking in butter, cream, cod-liver oil and is present in small quantities only in milk and milled cereals. The body can apparently store up very little of this essential and the results of a deficiency appear quickly after the supply in the diet has been eliminated. By contrast, the store of fat-soluble A is depleted much more slowly.

Water-soluble C has approximately the same properties as the others, but its absence from the diet leads to the development of scurvy. For this reason this vitamin is called the *"antiscorbutic substance."* It is found chiefly in fresh fruits and green leafy vegetables, but is also present in vegetable roots and tubers. The use of the juice of the citrus fruits to prevent and cure scurvy was well known during the era of long ocean voyages in slow sailing ships, and it is interesting to note that its rationale has been established by recent investigations. Infantile scurvy likewise was cured by the use of orange juice years before such therapy was removed from the realm of the purely empirical.

A Balanced Diet.—A dietary which includes all the above named foodstuffs in *proper proportions* may be called a *balanced diet.* With the present tendency toward prepared foods, the danger of a partial deficiency of one or another of the foodstuffs must be constantly borne in mind. By centuries of experience, human beings have learned to regulate their food intake to accord approximately with their needs, and consequently real deficiency manifestations occur only when the natural choice of food becomes limited by circumstances. In times of an increased demand for certain elements, as during pregnancy or during the period of active growth, the possibility of a failure of proper balance is, of course, far greater.

The various foodstuffs taken in the proportions indicated below will form a satisfactory balanced diet for a woman of average size doing a limited amount of work.

BALANCED DIET FOR AVERAGED-SIZED WOMEN

	Amount	Calories
Water	1000 to 2000 cc.	0
Carbohydrates (sugars and starches)	325 grams	1330
Proteins	100 "	410
Fats	50 "	460
Inorganic salts (mixed) total	10 to 20 grams	0
Vitamins (three varieties)	?	0
Total calories	......	2200

Calorific Feeding.—The energy requirements of the body are expressed in terms of calories—a calorie being the amount of heat required to raise the temperature of one liter (1 quart and 2 ounces) of water one degree Centigrade (1.8° F.). It is obvious that the respiration, the beat of the heart and other indispensable movements must result in the expenditure of considerable energy, even when the individual is at absolute rest, and it is apparent that voluntary motion must increase the need according to the amount of work performed. A woman of average size doing moderate work will require 2200 to 2500 calories per day. Pregnancy only increases this requirement in proportion as the skin area increases, when the weight becomes greater. The energy requirements of an adult are naturally greater than those of a child, but the increase is not proportional to the body weight, as it has been estimated that the former requires only 40 calories per kilogram per day, as compared with 70 calories required by the young infant. The explanation for this startling difference is found in the fact that the skin surface becomes proportionately greater as the size of the individual decreases, and that the energy demand depends upon the latter rather than upon the actual weight. Thus, it has been calculated that, while the newborn child weighs approximately one-twentieth as much as the grown woman, its skin area is about one-sixth as great.

A Satisfactory Diet During Pregnancy.—It has already been stated that during pregnancy the metabolic processes are more economically conducted than at other times. In consequence, there is no great need for change in the diet as regards its usual caloric value nor its content in protein, carbohydrate and fat. On the other hand, it seems that more attention should be paid to the other foodstuffs—the inorganic salts and the vitamins. As only small reserves of these substances are stored in the body, they cannot be depleted without affecting the mother's health and strength.

The inorganic salts are required in such small quantities by the adult that a diet relatively poor in them is quite sufficient for ordinary needs, but the growing fetus, especially near the end of its intra-uterine life, demands large amounts for the rapid growth of its tissues. All such materials must come through the mother's blood, and if they are not supplied by her food, they must be drawn from her own tissues. Hence, it is apparent that, in order to protect the maternal organism against such a theft, more than the usual amount of the various salts must be ingested. Cow's milk contains them in abundance and in such a form that they can be readily utilized. It should therefore be taken daily in reasonable quantities, say two glasses during the twenty-four hours.

Without doubt normal fetal growth depends partly upon the stimulating effect of the vitamins absorbed from the maternal circulation. Animal experimentation has shown that a lack in this respect results in undersized and weak offspring, which begin life with a great handicap. On the other hand, an abundant supply of these factors does not result in the birth of young of excessive size, apparently for the reason that the growth rate is limited by a hereditary impulse inherent in the species.

As has already been stated, the growing organism is more or less parasitic in nature, and consequently before the fetus suffers seriously from insufficient vitamins, the maternal stores must be thoroughly exhausted. For this reason a well-balanced obstetrical diet must contain these factors, which may be obtained as follows: Fat-soluble A from the milk recommended also for its calcium content, Water-soluble B from eggs, whole wheat and green vegetables, and Water-soluble C from the fresh fruits.

Reproductivity Influenced by Vitamins.—Common domestic animals, when placed upon a vitamin-poor diet, will either fail to reproduce, or will give birth prematurely to weak and puny young. No application of these facts to the human reproductive process has been made, but it seems probable that they may have an important bearing upon certain obstetrical problems.

A Satisfactory Diet During Lactation.—Perhaps a well-balanced diet is even more essential during lactation than at any other time, and certainly dietary deficiencies become more readily apparent. For some months the mother must eat to supply her own needs during a period of reconstruction and at the same time furnish all the materials demanded for growth in the child. Her metabolism is only normally economical, and an increased appetite is soon noticed—a part of nature's protective mechanism. This provision, together with the organism's inherent tendency to choose the correct food, will generally result in a satisfactory diet if it is available. It is nevertheless important that the various needs should be recognized and information made available as to how they may best be supplied.

For growth during convalescence, or for new growth in the infant, the actual building stones are needed to which reference has already been made. This would include a general increase in the intake of all the six foodstuffs. More water is demanded by the increased metabolism of growth as well as for the water making up the milk; more carbohydrates for the added energy requirements of the more active mother and for the formation of the sugar of the milk. Proteins and fats are needed for the new cells in both individuals, as are also the inorganic salts which form an indispensable part of all cellular structures. Finally, growth is promoted by an optimum quantity of vitamins, which is considerably above the actual maintenance demand. As the infant grows, it continually requires more nourishment, and the maternal diet must accommodate itself to the changing conditions.

Under the guidance of the appetite, the ingestion of water, protein, carbohydrate and fat will generally be sufficient, but unless intelligent choice is made, the intake of certain components of the other two groups of substances may be too restricted. Of the two most important inorganic materials, *iron* may be best obtained from meat, eggs, oatmeal, whole wheat and the green vegetables, especially spinach; while *calcium* will be obtained from milk, oatmeal and the leguminous vegetables. Fortunately, these foods also contain an abundance of the three accessory factors. Cow's milk and cream are efficient galactagogues, and, as they, in addition, possess practically all the properties of an ideal diet for the lactating mother, they should form an important part of any dietary scheme.

The Baby's Food.—Nature has provided the ideal food for all mammalian young in the breast milk of the mother. In different animals the relative proportions of the various constituents vary considerably, but are especially designed for the offspring of the species. In general, the protein and mineral components of milk vary with the rapidity of growth of the young. The human infant develops very slowly, doubling its birth weight only after five months, whereas the puppy accomplishes the same thing in eight days. Human milk contains 1.6 per cent of protein and 0.2 per cent of inorganic salts, while the bitch excretes a milk with 7.1 per cent of protein and 1.3 per cent of salts. Cow's milk also differs in various particulars from the human, and, in order to be made suitable for the infant, it should be diluted with water and certain additions made to it.

All the materials secreted in the milk must be brought by the blood stream to the breasts, where they are elaborated; but since the types of protein, fat and sugar in the milk are not identical with those in the circulating blood, we must seek an explanation for their transformation. At present, it is believed that the milk proteins have no relation to the serum albumin and globulin of the blood, but are formed from free amino-acids always circulating in it, which are elaborated into specific proteins in the cells of the mammary glands. The fats are derived from the lipoid (fat-like) substances in the blood and the lactose from blood glucose by complicated chemical reactions instituted by the same cells. On the other hand, it seems probable that water, inorganic salts and vitamins are diffused from the blood stream without alteration.

Human Milk.—Human milk is a bluish-white fluid presenting the appearance of diluted cow's milk. The white color is due to the presence of very numerous small droplets of fat suspended in the turbid fluid portion, which contains the protein, sugar and salts in watery solution. Under the microscope these fat drops are readily visible. The average chemical composition is as follows, and the table gives that of cow's milk for comparison.

The figures in the table are only averages, and it should be remembered that the composition of the milk from any individual is subject to considerable variations, depending largely upon her food and the amount of exercise she has taken. The more important of these alterations will be discussed later.

AVERAGE COMPOSITION OF HUMAN AND COW'S MILK[1]

	Parts in 100	
	Human	Cow's
Protein	1.25	3.50
Fat	3.50	4.00
Sugar	7.50	4.75
Salts	.20	.75
Water	87.55	87.00

[1] Holt.

Other Constituents of Milk.—Recently it has been shown that the non-protein nitrogenous materials constantly found in the blood are present in the milk and in like concentration. Among these, urea, uric acid, creatinin and the amino-acids may be mentioned. No practical significance is attached to these facts, but they are interesting as proof that some diffusible substances may pass through the cells of the breast acini. Additional evidence of such diffusion is offered by the behavior of commonly employed drugs. It has been demonstrated that the vegetable cathartics, alcohol, mercury, arsenic, quinin, potassium iodid, the opiates and other substances promptly appear in the milk following their administration to the mother. In this way the child occasionally may receive an amount of the drug sufficiently large to produce the characteristic physiological action. This is particularly true in the case of cathartics and opiates, and should always be borne in mind when ordering remedies for nursing women.

Specific immune bodies present in the maternal blood have been definitely demonstrated in the milk, but it is doubtful whether they can be utilized by the child for its protection, as such substances are quite unstable and are probably destroyed by the action of the digestive juices. The age-old observation that breast-fed children are more resistant to the usual infections can well be explained by their better general condition.

Except in the presence of active lesions of the mammary gland itself, bacteria probably do not appear in the milk. For this reason the danger to the child from a wet nurse suffering from tuberculosis or syphilis lies in the possibility of infection by other and more usual avenues.

The chemical composition of human milk as tabulated above shows that it has all the constituents of a perfect food, but the analytical methods as yet available fail to give any information concerning the presence of the accessory foodstuffs—the vitamins—which are so essential to health and growth. As none of these substances can be produced by the infant, its supply must come from its food, and recent observations have demonstrated that they are supplied by the milk when the mother is eating a well-balanced diet. Consequently, the nursing mother should be supplied with a liberal allowance of the vitamin-containing foods; milk, eggs, green vegetables and fresh fruits.

Colostrum.—Colostrum is the fluid secreted in small quantities by the breasts during pregnancy, and differs markedly from milk, as it contains more protein and salts, but less fat and sugar. In contrast to milk, it coagulates on heating, and, when viewed under the microscope, it contains fewer fat globules and a larger number of *colostrum corpuscles*—the remains of degenerated epithelial cells. The composition of cow's colostrum is given as water, 74.67 per cent; protein, 17.64 per cent; fat, 3.59 per cent; lactose, 2.67 per cent; and salts, 1.56 per cent. This would indicate that the fluid has some nutritive value, but, as it is secreted in such small quantities, its effect upon nutrition must be very slight. It is generally taught that some of its constituents have laxative properties and that its chief function is to stimulate the child's intestine to evacuate the meconium, which clogs the tract at the time of birth.

Alterations in the Quality and Quantity of the Milk.—The percentages of protein, sugar and salts in milk are relatively fixed, and vary only slightly with alterations in the character of the maternal diet. If sufficient milk-producing substances are not supplied in the food, the mother's tissues will be attacked to furnish the needed elements. The fat content may, however, be altered somewhat by variations in the fat consumption, and it has been shown that food high in carbohydrates and low in fats will give a "poor" milk, whereas the opposite will produce a "rich" milk. The accessory factors or vitamins will be secreted at the expense of the mother if the diet is deficient, and since her reserve of these is relatively small it is quickly exhausted.

The quantity of milk secretion is subject to great variations and may be influenced by the fluid intake, the character of the food and the general health of the mother. Ideal conditions for a continuous milk supply are furnished by an abundant ingestion of fluids and a satisfactory diet, combined with a normal manner of living and plenty of exercise in the open air. Experience shows that many patients who "cannot" nurse their children will be enabled by strict attention to these details to suckle them successfully until the proper weaning time.

Cow's Milk as Food for the Human Infant.—Undiluted cow's milk is not adapted to the needs of the young infant unless it has been modified to a considerable extent. As was seen in the comparative table on page 384, it contains about three times as much protein and salts, the same amount of fat and only about one-half as much sugar, as mother's milk. Consequently, it is essential that its composition be altered to approach the latter, and this is the purpose of the various formulae for the modification of cow's milk, which are in common use, although the fat content of the final mixture is usually ignored.

While the total salt content of cow's milk thus diluted corresponds closely to that observed in human milk, the relative proportion of certain of its individual mineral constituents is seriously affected. For example, the iron content of the full milk is only one-half that of mother's milk, so that when the former is diluted the ratio becomes so reduced that the child seemingly obtains too little of this substance. Mother's milk probably supplies an excess of iron, but when cow's milk is used a gradual diminution occurs in the iron reserves. This is usually well borne until the weaning period, when iron-containing foods are given, which restore the deficit. A satisfactory sugar content is obtained by the addition of either lactose (milk sugar) or cane sugar. Cow's milk contains the vitamins essential for growth and, even in the dilutions indicated, they are sufficient for the human infant. The need for water is partly supplied by the milk and partly by the water given as such during the day.

A simple formula for the modification of cow's milk suitable for a newborn child is the following:

Formula for Modifying Cow's Milk

Whole milk (mixed)	6 oz.	180.0 cc.
Sugar (2½ level tablespoonfuls)	1¼ oz.	35 grams
Water	14 oz.	420.0 cc.

This produces a mixture with approximately the following percentages:

	Per cent
Protein	1.00
Fat	1.20
Sugar	5.70
Salt	.32

One to two ounces (30 to 60 cubic centimeters) should be given at each feeding, and the feedings should be three to four hours apart. As the child grows, the capacity of the stomach increases, permitting larger feedings. At the same time the digestive system becomes better adapted to a more concentrated food, and, consequently, the proportion of whole milk is gradually increased and the water decreased. Infant feeding is properly considered in works on Pediatrics, but the following formulae will serve as a guide for the period during which an obstetrical nurse may be interested in the care of the child.

Whole-milk Formulæ[1]

	2 days	1 week	3 weeks	2 months	3 months
Whole milk (ounces)	6	7	8	9	10
Water (ounces)	14	13	12	11	10
Sugar (level tablespoonfuls)	2½	2½	2½	2½	2½
Fat content (per cent)	1.20	1.40	1.60	1.80	2.00
Sugar (per cent)	5.70	6.00	6.00	6.50	6.50
Protein (per cent)	1.00	1.20	1.40	1.60	1.75
Salts (per cent)	.22	.26	.30	.34	.38
Calories per ounce	11.5	12.5	13.5	14.5	15.5
Ounces per feeding	1	2	2½	3½	4½
Number of feedings per day	6	6	6	6	6
Calories per day	70	150	200	300	420

[1] Adapted from Holt.

It will be noticed that this method of modification produces a mixture which approximates human milk in its protein, sugar and salt content, but which contains considerably less fat. This is a distinct advantage during the early months, because experience has shown that, of the various ingredients, the fat of cow's milk is least adapted to the child's needs and that its use in excessive proportions frequently causes digestive disturbances. At the same time, the protein must be kept rather high, because the casein of cow's milk is not so completely utilized as the proteins of human milk. By gradually increasing the percentages of protein and fat, while maintaining the sugar at a constant level, the infant will thrive upon the substitute and at the age of nine months to one year will be able to assimilate undiluted cow's milk.

Top Milk Formulae.—Top milk from a bottle is still used in some institutions as the basis for various formulae. The cream or fat of the milk naturally rises on standing and is removed by pouring or dipping with a suitable vessel. The top-most layer contains the highest percentage of fat, as is indicated in the accompanying table, while the lowest portion is nearly fat-free. There is no such variation in the protein, sugar and salt concentrations, and for practical purposes the slight changes which do occur may be ignored.

Chapin and Pisek's table, which follows, shows the percentage of fat in different quantities of top milk from a quart bottle.

FAT PERCENTAGE IN TOP MILK OF QUART BOTTLE

Fat					
	Ounces	Per cent		Ounces	Per cent
Top..........	4	21.4	Top........	16	7.0
"	6	16.8	"	18	6.3
"	8	13.3	"	20	5.8
"	10	10.5	"	22	5.4
"	12	9.0	"	24	5.0
"	14	7.8	"	32	4.1

The following table shows in a general way the method of modification and the percentage composition obtained.

TOP-MILK FORMULÆ

Age	Quantity made up	Ingredients			Final percentage composition		
		Top milk	Water	Sugar	Protein	Fat	Sugar
1 to 6 days.....	20 oz.	2½ oz. of top 9 oz.	17½ oz.	1 oz.	.40	1.5	6.0
2 to 4 weeks....	28 oz.	7 oz. of top 9 oz.	21 oz.	2 oz.	.80	3.0	7.0
2d month......	32 oz.	12 oz. of top 16 oz.	20 oz.	1½ oz.	1.20	2.6	7.0
3d month......	32 oz.	16 oz. of top 20 oz.	16 oz.	1½ oz.	1.60	3.0	7.0

Preparation of the Formulae.—Milk from a mixed herd is preferable to that from a single cow because its composition is subject to smaller variations from day to day. It is essential that the milk be obtained under sanitary conditions and kept well iced until used. The required amounts of whole or top milk, water and sugar, are measured into a sauce-pan of suitable size, the mixture is rapidly heated to boiling and held there for one minute. Prolonged boiling should be avoided because it destroys some of the vitamins. The quantity desired for each feeding during the day is placed in the necessary number of sterile bottles, and kept on ice until needed. Especially during warm weather, great care must be exercised to prevent bacterial growth. For more detailed information about infant feeding, the nurse is referred to the various textbooks on children's diseases.

The Wet Nurse.—Especially in the case of premature infants, the use of human milk supplied by a wet nurse is frequently advisable. The woman chosen must be free from syphilis, tuberculosis or other contagious disease and should have been delivered at least one month previously. By this time her milk will have attained a constant composition and all the breast tissue will be actively secreting. The old habit of putting the second child directly to the breasts has been largely discontinued and replaced by manual expression under regulated conditions, as it is more sanitary and permits actual measuring of the amounts fed. At definite intervals throughout the day the nurse or the patient herself "milks" the breasts and collects the secretion under aseptic precautions. It is then cooled and kept on ice until needed. Each milking should represent the entire secretion from one or both breasts, in order to obviate the variations in compositon, which occur in the milk at the beginning or the end of the process, as the latter will be peculiarly high in fat and low in the other constituents. The wet nurse's own child may well be fed the expressed milk by means of a bottle, which will insure it a sufficient amount and will stabilize the composition of the milk fed the other children.

What has been said concerning the diet of lactating women applies particularly to the wet nurse. Consequently, her food should be carefully supervised, in order to insure a balanced ration, and great stress should be laid especially upon a large intake of milk and water, for under such conditions the mammary glands will be stimulated to extraordinary activity, which can be maintained for some months. It should be remembered that frequent complete expression is needed to stimulate secretion to the maximum.

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